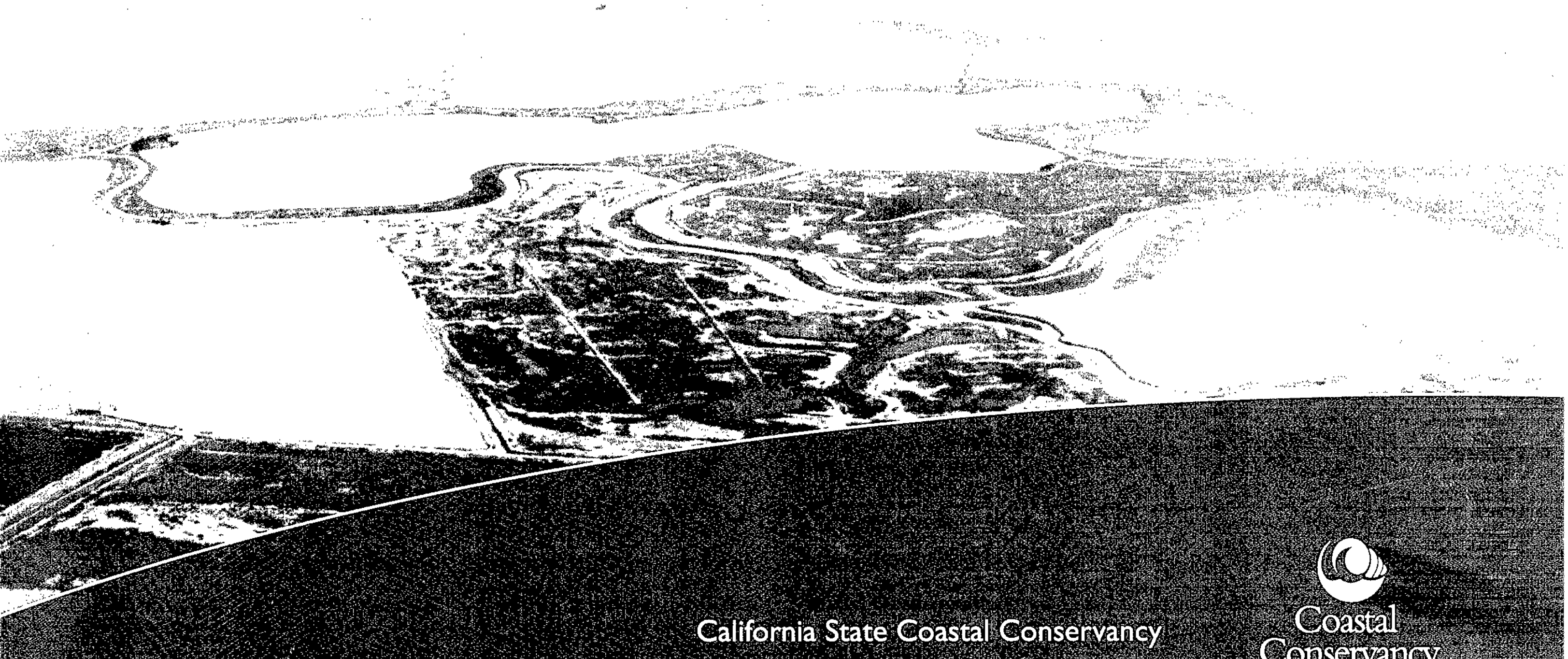
River Salt Marsh Restoration Project

I: Final Environmental Impact Statement



California State Coastal Conservancy

Coastal Conservancy

U.S. Army Corps of Engineers

California Department of Fish & Game

Final
Napa River Salt Marsh Restoration Project
Environmental Impact Statement

Volume 1

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Contents

Page

Tables

Figures

Follows Page

Acronyms and Abbreviations

1-D	one-dimensional
2-D	two-dimensional
AACL	acceptable ambient concentration level
ABA	Architectural Barriers Act
ABAG	Association of Bay Area Governments
ADA	Americans with Disabilities Act
af	acre-feet
ANFO	ammonium nitrate with 5.3–8% fuel oil
ATCM	air toxic control measure
BAAQMD	Bay Area Air Quality Management District
Basin Plan	*Water Quality Control Plan, San Francisco Bay Region*
Bay-Delta	San Francisco Bay/Sacramento–San Joaquin River Delta
BCDC	San Francisco Bay Conservation and Development Commission
Bay Plan	BCDC Bay Plan
BMP	best management practice
BOD	biological oxygen demand
CAA	Clean Air Act
CAAQS	California ambient air quality standards
Cal/EPA	California Environmental Protection Agency
CALFED	CALFED Bay-Delta Program
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CAP	Clean Air Plan
CAR	Fish and Wildlife Coordination Act Report
CARB	California Air Resources Board
CASAC	Clean Air Scientific Advisory Committee
CCMP	Comprehensive Conservation and Management Plan
CCR	California Code of Regulations
CDMG	California Division of Mines and Geology
CEQ	President's Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPPA	California Native Plant Protection Act
CNPS	California Native Plant Society
CO	carbon monoxide

Coastal Conservancy	California State Coastal Conservancy
Corps	U.S. Army Corps of Engineers
CTR	California Toxics Rule
CUPA	certified unified program agency
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibels
DDE	dichlorodiphenyldichloroethelene
DDT	dichlorodiphenyltrichloroethane
DFG	California Department of Fish and Game
DHS	Department of Health Services
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DTM	Digital Terrain Model
EFH	essential fish habitat
EIR/EIS	environmental impact report/environmental impact statement
EPA	U.S. Environmental Protection Agency
ER-L	Effects Range–Low
ER-M	Effects Range–Median
ERPP	Ecosystem Restoration Program Plan
ESA	federal Endangered Species Act
ESU	evolutionarily significant unit
FR	Federal Register
FWCA	Fish and Wildlife Coordination Act
GIS	geographic information systems
gpm	gallons per minute
H_2S	hydrogen sulfide
ha	hectare
HAP	hazardous air pollutant
HCP	habitat conservation plan
HDPE	high-density polyethylene
HMTA	Hazardous Materials Transportation Act
HSMEW	Hudeman Slough Mitigation and Enhancement Wetlands
I-80	Interstate 80
IARC	International Agency for Research on Cancer
kv	kilovolt
LC50	concentration lethal to 50% of an exposed test population
L_{dn}	day-night equivalent sound level
L_{eq}	equivalent sound level
LGVSD	Las Gallinas Valley Sanitary District
LOS	level of service
LUST	leaking underground storage tank
MAD	mosquito abatement district
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
μg/kg	micrograms per kilogram
MHHW	mean higher high water
MHW	mean high water

MMP	mitigation and monitoring plan
MOU	memorandum of understanding
MRL	method reporting limit
MSAT	Mobile Source Air Toxic
MTAG	Modeling Technical Advisory Group
MTC	Metropolitan Transportation Commission
MTL	mean tide level
N	nitrogen
NAAQS	national ambient air quality standards
Napa River Unit	Napa River Unit of the Napa-Sonoma Marshes Wildlife Area
NAVD	National Annual Vertical Datum
NCMAD	Napa County Mosquito Abatement District
ND	no data available
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO	nitric oxide
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service
NOI	notice of intent
Novato SD	Novato Sanitary District
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSD	Napa Sanitation District
NSMWA	Napa-Sonoma Marshes Wildlife Area
NTU	nepholometric turbidity unit
NWPRA	Northwestern Pacific Railroad Authority
O_3	ozone
O_3 Attainment Plan	*San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard*
O&M	operations and maintenance
P	phosphorus
PAHs	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PG&E	Pacific Gas and Electric Company
pg/l	picograms per liter
PM10	particulate matter less than 10 micrometers in diameter
ppb	parts per billion
Ppm	parts per million
ppt	parts per thousand
project sponsors	California State Coastal Conservancy, U.S. Army Corps of Engineers, and California Department of Fish and Game
PVC	polyvinyl chloride
PWA	Philip Williams and Associates
RCRA	Resource Conservation and Recovery Act
RHA	Rivers and Harbors Act
RMP	Regional Monitoring Program
RMS	Root-Mean-Square
ROG	reactive organic gases
ROW	right-of-way
RWQCB	regional water quality control board

SARA	Superfund Amendments and Reauthorization Act
SC	species of concern
SCWA	Sonoma County Water Agency
SFBAAB	San Francisco Bay Area Air Basin
SFBJV	San Francisco Bay Joint Venture
SFEP	San Francisco Estuary Project
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SNA	Significant Natural Area
SO_2	sulfur dioxide
SO_x	sulfur oxides
SR	State Route
SSC	species of special concern
SVCSD	Sonoma Valley County Sanitation District
SWANCC	Solid Waste Agency of Northern Cook County
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
TBT	trybutyltin
TDS	total dissolved solids
TMDL	total maximum daily load
TNT	trinitrotoluene
TSS	total suspended solids
UBC	uniform building code
UCD	University of California, Davis
URL	Uniform Resource Locator
U.S. 101	U.S. Highway 101
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTM	Universal Transverse Mercator
Vs	shear-wave velocity
WCB	Wildlife Conservation Board
WDR	waste discharge requirement
WWTP	wastewater treatment plant

Glossary

acute toxicity: For purposes of this project, a median of less than 90% survival, or less than 70% survival more than 10% of the time, of test organisms in a 96-hour static or continuous flow test. See also *chronic toxicity.*

adsorption: The adherence of a gas, liquid, or dissolved material on the surface of a solid.

anoxic: Greatly deficient in oxygen; oxygenless as with water.

anthropogenic: Involving the impact of humans on nature; induced, caused, or altered by the persence and activities of humans, as in water and air pollution.

benthic organisms: Those organisms living at or near the bottom of a body of water.

bioaccumulation: The increase in concentration of a chemical in organisms that reside in environments contaminated with low concentrations of various organic compounds. Also used to describe the progressive increase in the amount of a chemical in an organism resulting from rates of absorption of a substance in excess of its metabolism and excretion.

biotic: Pertaining to life or living things, or caused by living organisms.

bittern: Waste materials left over after table salt (sodium chloride) was harvested from the salt ponds. Shown in laboratory studies to have toxic effects on aquatic life.

bittern pond: A repository of concentrated soluble salts other than sodium chloride. For purposes of this project, refers to Pond 7.

brackish water: Water containing a mixture of seawater and fresh water; contains dissolved materials in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses.

CAC Pipeline: The pipeline proposed to carry recycled water from the City of American Canyon wastewater treatment plant as part of the Water Delivery Option.

channel density: The amount of channel habitat per acre of marshplain.

chronic toxicity: A detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. See also *acute toxicity.*

congeners: Elements belonging to the same group on the periodic table (e.g., sodium and potassium); compounds produced by identical synthesis reactions and procedures.

cytochemical: Related to the chemistry of cells.

demersal: Dwelling at or near the bottom of a body of water.

diadromous fishes: Fishes that migrate through estuaries on their way either to fresh water or to salt water. Includes anadromous species, which migrate from salt water to spawn in fresh water, and catadromous species, which migrate from fresh water to spawn in the ocean.

diurnal: Having a daily cycle.

donut: A circular water control structure that has multiple intakes and that is used to distribute water through the canal and siphon system.

essential fish habitat: Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

eutrophication: Overenrichment of a lake or other water body with nutrients, resulting in excessive growth of organisms and the depletion of oxygen.

ground lurching: The horizontal movement of ground located adjacent to slope faces during strong, earthquake-induced ground motion.

hazardous air pollutant: The classification, under federal law, for a pollutant that increases the public's risk of developing cancer. See also *toxic air contaminant.*

hemiparasitic: Partially dependent on another host plant in order to survive.

high marsh: See *upper tidal marsh.*

histopathological: Pertaining to the tissue changes that affect a part or accompany a disease.

hygroscopic: Describing a chemical substance with an affinity for water, one that will absorb moisture, usually from the air.

hypoxic: Refers to natural waters that have a low concentration of dissolved oxygen (about 2 milligrams per liter as compared with a normal level of 8–10 milligrams per liter).

infauna: Aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom.

lateral spreading: The horizontal displacement of soil during strong, earthquake-induced ground motion.

lower ponds: The ponds in the project area located south of Napa Slough, i.e., Ponds 1, 1A, 2, 3, 4, 5, 6, and 6A.

lower tidal marsh: Habitat that occurs above mudflats along stream and slough channels and typically is found between mean tide level and mean high water (3.3(5.5 feet National Annual Vertical Datum 88). Within the range of daily tidal fluctuations; ground surface and low-growing plants are exposed at low tides and completely inundated at higher tides and during periods of high stream discharge.

methylation: Conversion of sediment-bound mercury may through both biotic and abiotic processes to its more bioavailable methylated form. Methyl mercury has known neurological toxicity effects that tend to increase at each level up the food chain in aquatic environments. Thus, the availability of such contaminants, even in the seemingly insignificant parts per trillion range, often are ecologically important.

microtidal marsh, muted tidal marsh: A tidal marsh that receives less than full tidal flow because of a physical impediment. Muting can result from the presence of natural formations such as a sand bar or of human-made structures such as tide gates, culverts, or other water control structures. Muted tidal marshes exhibit many of the same features of fully tidal marshes, although they frequently lack the same range of plant diversity.

middle tidal marsh: Habitat that occurs between mean high water and mean high higher water (5.5(6.0 feet National Annual Vertical Datum 88); inundated only during higher high tides.

mutagenicity: The capacity to induce a mutation or an abrupt change in the genetic constitution of an organism.

Napa Pipeline: The pipeline proposed to carry recycled water from the Napa Sanitation District wastewater treatment plant as part of the Water Delivery Option.

nonattainment areas: Areas that do not meet the national ambient air quality standards established in 1970 by the Clean Air Act.

organoarsenical: Of, relating to, or being an organic compound that contains arsenic.

pelagic: Referring to the open sea at all depths.

point-source discharge: A discharge of a pollutant from an identifiable point, such as a pipe, ditch, channel, sewer, tunnel, or container.

project sponsors: For purposes of this project, refers to the California State Coastal Conservancy, U.S. Army Corps of Engineers, and California Department of Fish and Game.

saline wedge: Viscous, dense brine that forms in the siphon when the denser, heavier saline water falls to the bottom of the siphon and blocks the passage of water.

sessile: Sitting directly on base without support, stalk, pedicel, or peduncle; attached or stationary as opposed to free living, or exhibiting or capable of movement.

soil liquefaction: The sudden and total loss of soil strength during earthquake-induced ground motion. Occurs in loose, saturated, clean sand where ground shaking increases effective pore pressure resulting in the displacement of individual sand grains and groundwater. The soil transforms into a fluid-like state, allowing displacement of water and the potential mobilization of sand if not confined.

Sonoma Pipeline: The pipeline proposed to carry recycled water from the Sonoma Valley County Sanitation District wastewater treatment plant as part of the Project Component of the Water Delivery Option.

specific yield: A measure of aquifer productivity; the volume of water drained divided by the total volume of the sample.

teratogenicity: The capacity to cause birth defects.

tertiary wastewater treatment: Selected biological, physical, and chemical separation processes to remove organic and inorganic substances that resist conventional treatment processes; the additional treatment of effluent beyond that of primary and secondary treatment methods to obtain a very high quality of effluent.

tidal muting: The restriction of tidal flow by friction; contributes to channel shape and form as a result of erosion and sedimentation.

tidal prism: The volume of water that flows into and out of a marsh.

Total Maximum Daily Load program: A quantitative assessment of a problem that affects water quality. Establishes the amount of a pollutant present in a water body and specifies an allowable load of the pollutant from individual sources to ensure compliance with water quality standards.

toxic air contaminant: The classification, under California law, for a pollutant that increases the public's risk of developing cancer. See also hazardous air pollutant.

trophic level: Stage in a food chain or web leading from primary producers (lowest trophic level) through herbivores to primary and secondary carnivores (consumers—highest level).

tsunami: A seismically induced flood caused by the transfer of energy from an earthquake epicenter to coastal areas by ocean waves.

turbidity: A measure of the reduced transparency of water due to suspended material that carries water quality implications.

upper ponds: The ponds in the project area located north of Napa Slough, i.e., Ponds 7, 7A, and 8.

upper tidal marsh: Habitat that occurs from mean high higher water and up several feet (>6.0 feet National Annual Vertical Datum 88) to the maximum elevation of tidal effects. This habitat is inundated only during higher high tides.

zooplankton: Floating and free-swimming invertebrates that are suspended in the water column.

Summary

S.1 Project Background

The California State Coastal Conservancy (Coastal Conservancy), U.S. Army Corps of Engineers (Corps), and California Department of Fish and Game (DFG) (project sponsors) are proposing a salinity reduction and habitat restoration project for the ~~9,456~~9,460-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area (NSMWA) (Napa River Unit). The parcel was purchased with funds from the Shell Oil Spill Settlement, State Lands Commission, Wildlife Conservation Board, and the Coastal Conservancy. The Napa River Unit is located at the northeast edge of San Pablo Bay, adjacent to the Napa River (Figure S-1).

The Napa River Unit was first diked off from San Pablo Bay during the 1850s for hay production and cattle grazing. Dike construction continued for several years and much of the land was converted to salt ponds in the 1950s for salt production through the solar evaporation of bay water. In the early 1990s, Cargill Salt Company stopped producing salt in the ponds on the west side of the Napa River and sold the evaporator ponds to the State of California, which assigned ownership and management to DFG.

The site consists of 7,190 acres of salt ponds and levees and 2,266 acres of fringing marsh and slough. For the purpose of this document, Ponds 1, 1A, 2, 3, 4, 5, 6, and 6A will be referred to as the *lower ponds*. Ponds 7, 7A, and 8 will be referred to as the *upper ponds*. The lower ponds are located south of Napa Slough; the upper ponds are located north of Napa Slough. Detailed site topography was collected and used for the project as described in Chapter 3, "Hydrology." Additional pond salinity and water quality information is provided in Chapter 4, "Water Quality."

Restoration of the Napa River Unit has long been a vision for local resource agencies, conservationists, and planners. It is one of the largest tidal restoration projects on the west coast of the United States, and one of many restoration projects throughout the San Francisco Bay area. Baywide restoration planning, including historical and existing conditions and future habitat recommendations, was conducted as part of the Baylands Ecosystem Habitat Goals Project (Goals Project 1999) and provides a regional framework for this project.

S.2 Purpose and Need

The purpose of the project is to restore a mosaic of habitats, including tidal habitats and managed ponds, to this property and provide for better management of ponds in the Napa River Unit to support populations of fish and wildlife, including endangered species, migratory waterfowl, shorebirds, and anadromous and resident fish. Other important benefits of the project include improved water quality, the potential use of recycled water, and enhanced public open space and wildlife-compatible recreation opportunities. The long-term goal is to produce a natural, self-sustaining habitat that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

The project is needed because of

- historical losses of marsh ecosystems and habitats;
- increasing salinity and declining ecological value in several of the ponds;
- <u>the collapse of the pond system ecology in the absence of salt production or rehabilitation as tidal habitat;</u>
- deterioration of levees, which could lead to levee breaches and uncontrolled high-salinity discharges, resulting in potential fish kills;
- deterioration of water control structures, which exacerbates the increase in salinity;
- increased restoration costs associated with site deterioration;
- increasing operation and maintenance costs; and
- inadequate water supply, especially during the summer months, resulting in increased salinity, acidic conditions, and drying out of some ponds in summer.

Restoring tidal wetlands, including tidal marsh, within the Napa River Unit would benefit the natural environment by creating

- a large area of contiguous tidal marsh for a diversity of fish and wildlife, including threatened and endangered species (salt marsh harvest mouse, California clapper rail, and black rail);
- a greater variety of slough channel sizes, a large increase in slough habitat, and greater connections among San Pablo Bay, the Napa River, and the tidal salt marsh, which would benefit estuarine fish, including listed species (Delta smelt, splittail, steelhead trout, and chinook salmon) and other aquatic species, such as the Dungeness crab;
- a natural, self-sustaining system that could adjust to naturally occurring changes in physical processes, with minimum ongoing intervention;
- large tracts of tidal marsh that extend up the Napa River that allow fish and wildlife species to adjust to changes in salinity that occur seasonally and over longer periods because of variations in precipitation;

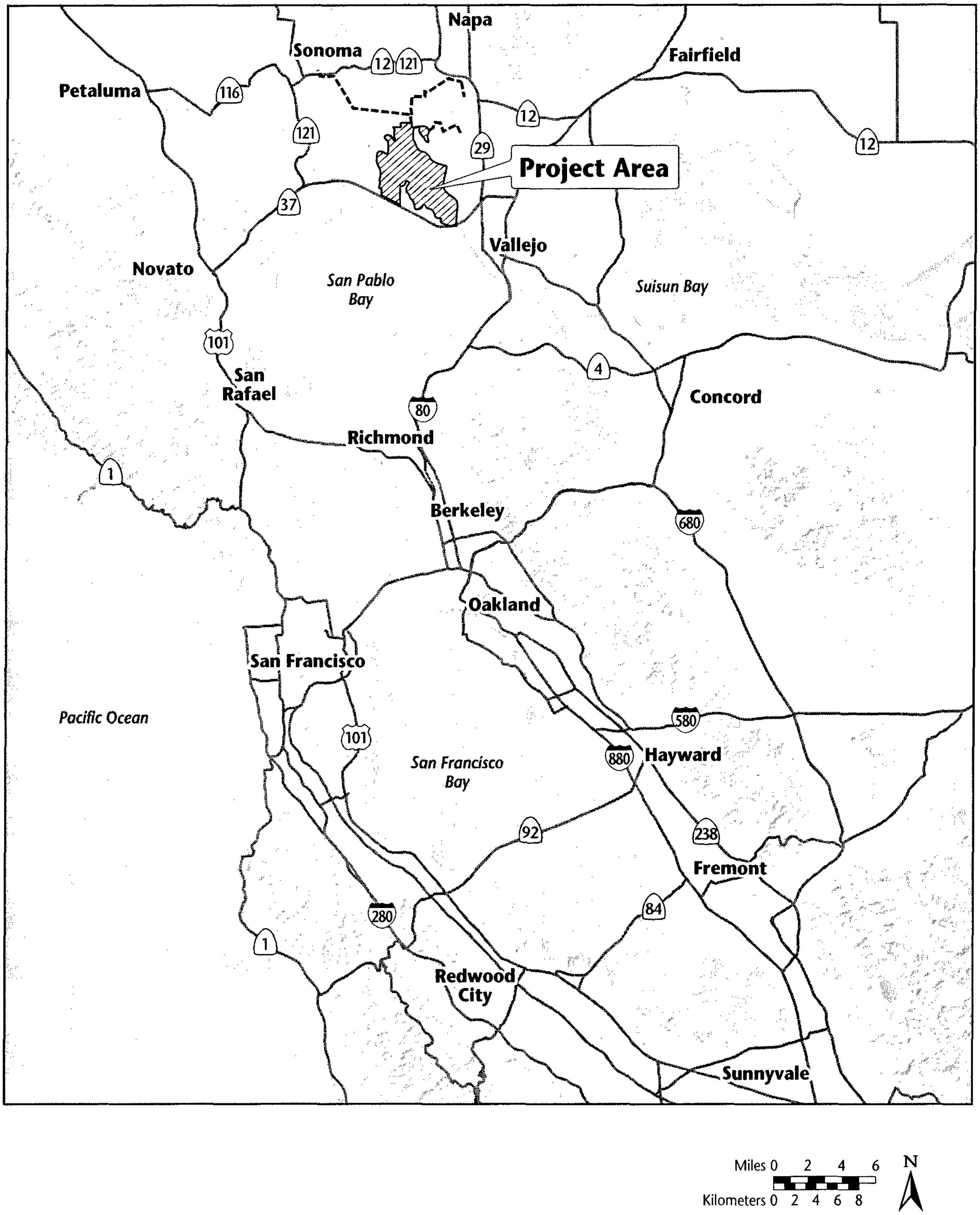

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Figure S-1
Regional Location

- increased tidal prism that would scour slough channels, eventually creating large tidal channels, benefiting fish and diving waterfowl;
- improved tidal circulation throughout the system, improving water quality; and
- greatly increased production of organic detritus by tidal marshes, increasing the ecological productivity of San Pablo Bay.

Diking or filling has destroyed approximately ~~82~~85–90% of the original tidal wetlands of the San Francisco Bay area ~~(Goals Project 1999)~~. The loss of tidal wetlands has greatly reduced the amount of habitat available to many species of fish and wildlife. Several animal and plant species native to California, including the salt marsh harvest mouse and the California clapper rail, have been federally and state listed as endangered as a result of the severe reduction of wetland habitats.

Salinity is increasing and ecological values are declining in several of the ponds in the Napa River Unit. DFG's ability to maintain the levee system and to control water levels, salinity, and water quality in the ponds is limited by funding and infrastructure constraints. The primary limitations to DFG's successful management are the high cost of running poorly performing water intake pumps and the low hydroconnectivity between ponds. The current pumps do not supply enough water to prevent increases in salinity concentrations, especially during seasonal periods of low precipitation and high water evaporation. Upgraded water intake pumps combined with levee reconstruction would result in improved hydroconnectivity and would enable DFG to improve migratory waterfowl management activities.

Several of the salt pond levees are deteriorating. The ponds are considered a potential threat to the ecology of the north bay region because of the presence of large quantities and high concentrations of residual salts. It has been estimated that there are 2–4 million tons of salt in the ponds. During the commercial production of salt, the solar evaporation system moved bay water through the ponds in sequence as the salts became concentrated. As a result, the ponds further along in the system have salinity levels that exceed the salinity level of seawater (ranging from approximately 32 parts per thousand [ppt] to more than 400 ppt).

The salt production process also concentrated soluble salts other than sodium chloride. These additional salts were generally not harvested and accumulated in the pond system in solutions and precipitates known as *bittern*. The uncontrolled release of bittern would be detrimental to the aquatic environment. Additionally, when the~~the drying action of~~ salt ponds dry out as a result of lack of water, ~~creates~~ undesirable low pH (acidic) values are created.

The annual evaporative water loss from the salt ponds substantially exceeds the amount of water replaced by annual rainfall. Therefore, without active water management, the salt ponds would become increasingly saline and turn into seasonally wet salt flats—or worse, bittern ponds—resulting in the loss of most of their present habitat value for waterbirds and other wildlife species.

Although the water lost through net evaporation can be replaced by water drawn from San Pablo Bay and the lower Napa River, these sources also contain salts that will become concentrated in the ponds over time. The limited capacity and high operating costs of the pumps used to draw water into the ponds are also problematic. Additional infrastructure constraints further limit the ability of DFG to move replacement water into the ponds.

S.3 Alternatives Screening Process

Several approaches were used to develop and screen alternatives for the Napa River Salt Marsh Restoration Project, including using a restoration decision flowchart developed by the project team (Figure S-2) and the Corps's *Economic and Environmental Principles and Guidelines for Water Related Land Resources Implementation Studies* identified in the Corps's *Planning Guidance Notebook (ER 1105-2-100)* (U.S. Army Corps of Engineers 2000a), which includes screening based on effectiveness, efficiency, completeness, and acceptability. Environmental, economic, and social screening criteria were also used to evaluate and screen restoration components.

Each of the alternatives includes salinity reduction and habitat restoration features. Because of the complexity of the restoration and desalination process, restoration options and salinity reduction options were developed and analyzed separately. A wide range of both types of options was identified and evaluated at a screening level. Options that were identified as viable in the first round of screening were retained for more detailed evaluation. Project alternatives were then created by combining salinity reduction options and habitat restoration options in various combinations (see Chapter 17, "Integration of Options and Alternative Selection"). Salinity reduction options were further subdivided into two components—the salinity reduction process, and supplemental (fresh or recycled) water delivery. By evaluating the salinity reduction and habitat restoration options separately, the maximum feasible range of integrated alternatives was considered.

Preliminary screening of the salinity reduction options was achieved by conducting initial hydrologic modeling runs to determine the feasibility of various salinity reduction approaches. The water delivery options were evaluated by assessing the economic and institutional feasibility. The habitat restoration options were screened by characterizing the evolution of the site over time with varying assumptions. The most viable options were carried forward for consideration as potential project options. Potential habitat restoration options were then presented to the Napa-Sonoma Marsh Restoration Group for review and critique.

Twenty-four salinity reduction, seven habitat restoration, and three supplemental water delivery options were considered at the screening stage. Of these, 21 salinity reduction options, three habitat restoration options, and two water delivery options were eliminated from further analysis because of criteria described above. These options fall into several general categories:

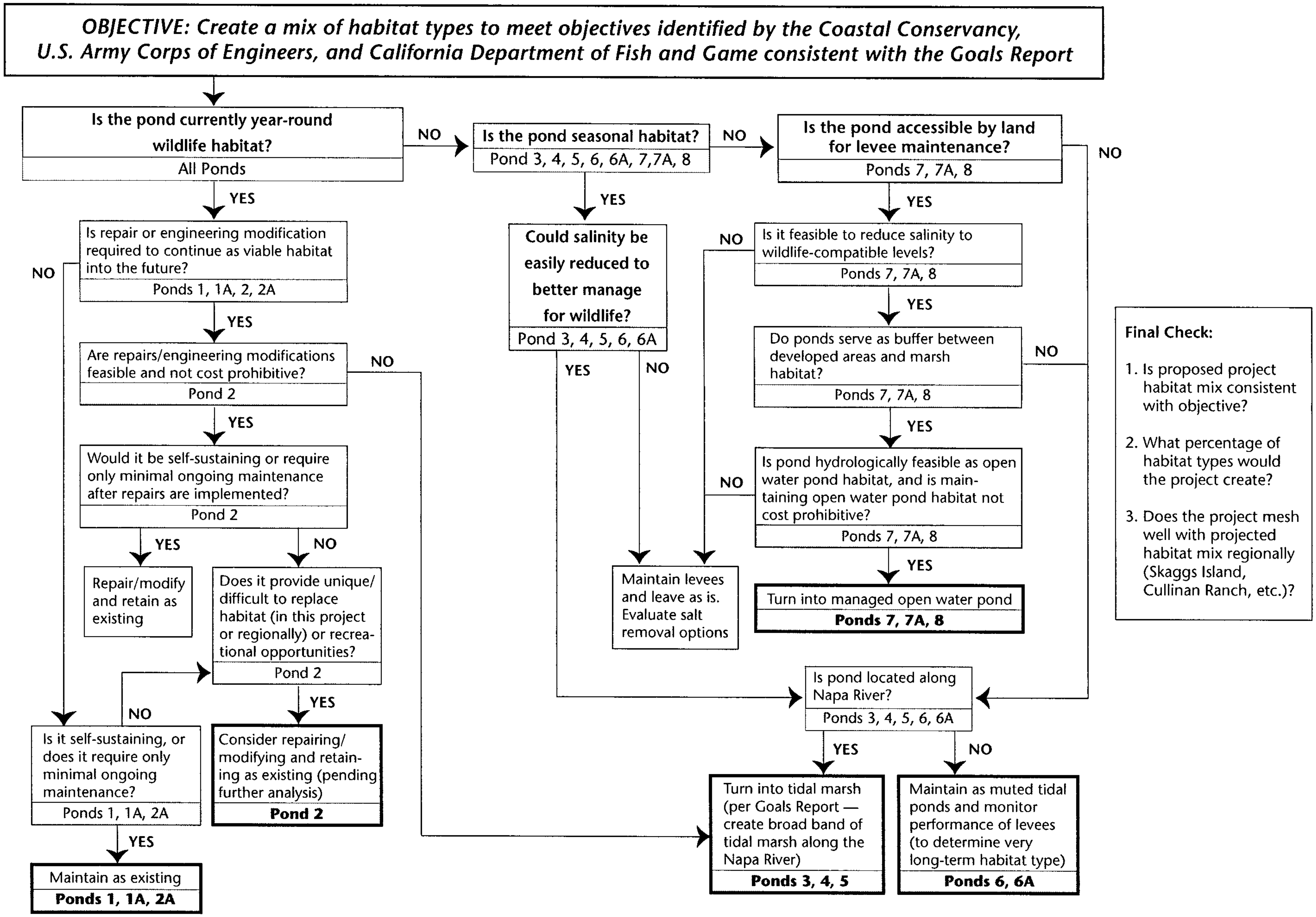

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Figure S-2
Napa River Salt Marsh Restoration Project Decision Flowchart

- salinity reduction options:
  - reverse operation of the ponds,
  - concentration of brine in one or more central ponds,
  - physical removal of the bittern,
  - use of only recycled water to desalinate all ponds, and
  - flood event salinity reduction;
- water delivery options:
  - maximum recycled water delivery and
  - use of site groundwater;
- habitat restoration options:
  - species-focused options,
  - land exchange, and
  - sediment-import options.

S.4 Intent and Scope of the ~~EIR/~~EIS

The intent of this ~~environmental impact report/~~environmental impact statement (~~EIR/~~EIS) is to disclose the environmental impacts associated with this restoration project. The restoration effort would have substantial habitat benefits by restoring portions of the Napa River Unit to a mosaic of wildlife habitats consisting of managed ponds and tidal marsh but may result in significant hydrologic, water quality, and biological effects.

In accordance with both California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) regulations, this document individually describes environmental effects caused by the construction, operation, and maintenance activities related to restoring the Napa River Unit. It focuses on key issues, including hydrology, water quality, biological resources (vegetation, wildlife, and aquatic resources), and geology and soils. Other resource topics such as air quality, hazardous materials, noise, land use, recreation, and cultural resources are also addressed in this document.

S.5 Options Evaluated in This ~~EIR/~~EIS

Three sets of options are evaluated in this ~~EIR/~~EIS. Because both salinity reduction and habitat restoration are required to complete the project, the habitat restoration options are combined with appropriate salinity reduction options and water delivery options (Chapter 17, "Integration of Options and Alternative Selection") to document the full extent of potential impacts associated with complete alternatives. In addition, ~~both CEQA and~~ NEPA requires evaluation of

a no-project alternative. This section describes first the No-Project Alternative, then the salinity reduction options, the water delivery options, and the habitat restoration options.

S.5.1 No-Project Alternative

Under this alternative (depicted in Figure S-3), site conditions would continue to deteriorate and salinity in the ponds would continue to increase. DFG would manage the site to reduce day-to-day pond salinity, if possible, by taking San Pablo Bay water into Ponds 1 and 1A and Napa River water into Pond 8 and moving water through the pond system via water control structures. Annually there would be a net increase in the total salt load within the ponds. Water would be delivered to the system from two locations: the new intake at Pond 8 and the pump station that transfers water from Pond 1 into Pond 2. The flow from the intakes to the remaining ponds is driven by elevation ("head") differential. The ponds would be expected to dry out more frequently as siphons continue to be or become inoperable as a result of increased salinity gradients. Other water control structures would continue to deteriorate, reducing DFG's ability to manage water levels and pond salinity for wildlife habitat.

As long as DFG attempts to maintain the ponds' water levels by compensating for annual net evaporation, the salt mass in the ponds would increase dramatically from year to year. In the short term, depending on the amount of make-up water available for each pond, some ponds could dry out each year. In the long term, the increasing salinity in the ponds would reduce evaporation rates sufficiently that the estimated available amount of water would be sufficient to keep the ponds wet all year. As long as the amount of make-up water delivered to the ponds was kept the same, water levels would then slowly start to rise, and eventually water deliveries would have to be cut back to avoid overfilling the ponds. However, salinities in the ponds, even after the wet season, would soon exceed 350 ppt (the approximate solubility of sodium chloride), and sodium chloride would start to precipitate. As the salinity continues to increase, the liquid in the ponds would gradually turn into bittern; all the sodium chloride would precipitate, and the remaining brine would have the same composition as the bittern waste left over after the saltmaking process.

Although DFG would attempt to manage the ponds, as long as there is not a flow-through system, sufficient salt would accumulate in the ponds that all of the ponds that lack flow-through capability (i.e., Ponds 4–7A~~8~~) would turn first into highly saline brine and then into bittern ponds with a large precipitated salt mass. Thus, all of the ponds would eventually pose the type of ecological hazards currently posed by Pond 7. Coupled with the inevitable deterioration of the levees, the ponds would present a serious ecological threat.

Ongoing erosion of inboard levees by wind and waves and scour of outboard levees, in conjunction with high tides and high rainfall events, would likely result in one or more levee breaches. DFG would potentially fix the levees on an emergency basis as needed. Because of the remote locations and emergency

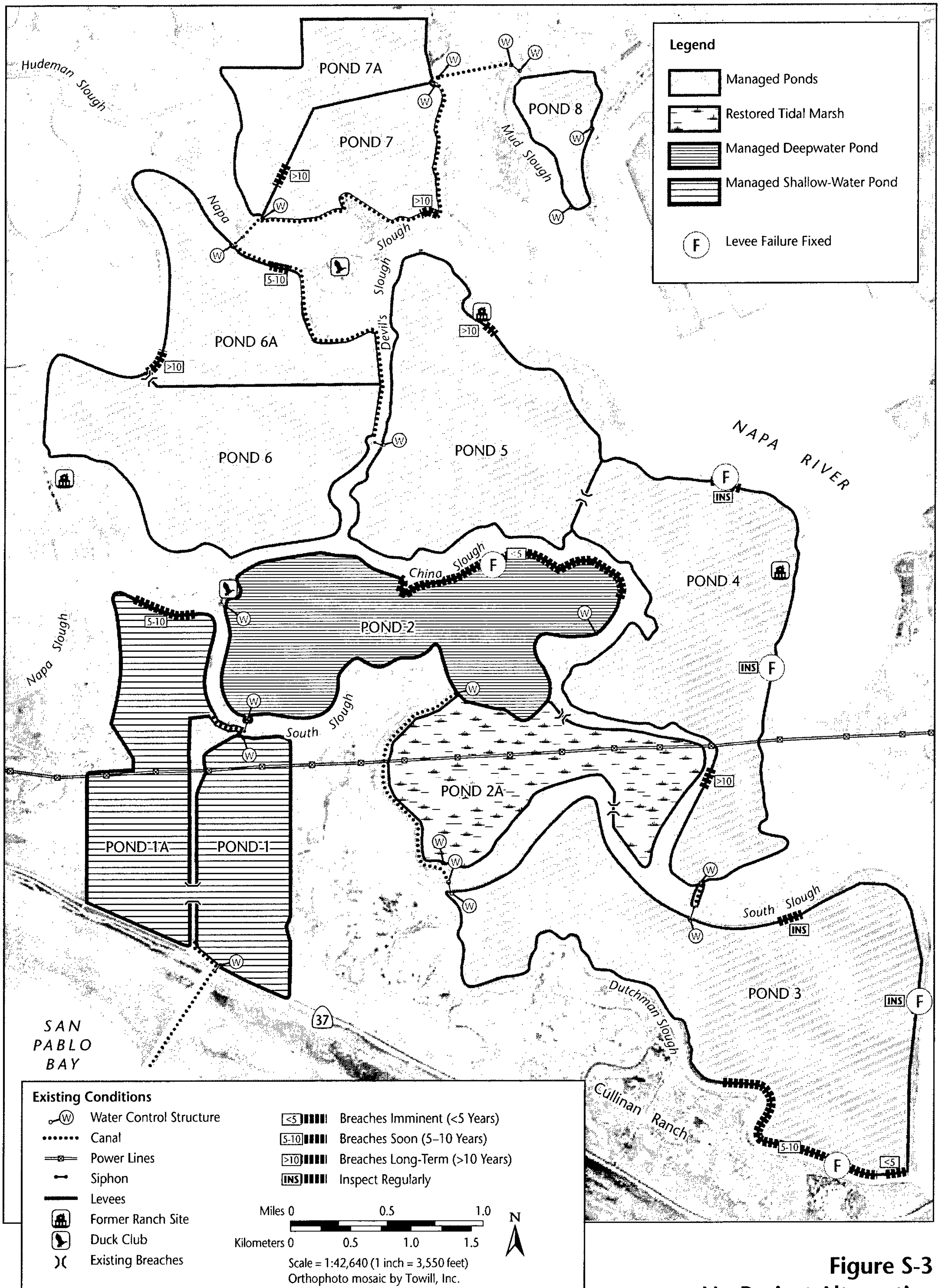

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Figure S-3
No-Project Alternative

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contracting issues, however, these repairs often cannot be started in a timely manner, and much of the potential damage (i.e., possible fish kills) resulting from uncontrolled releases of highly saline water or bittern would be instantaneous.

In August 2002, an unknown party dug a small 2-foot-wide ditch between Pond 3 and South Slough. While this ditch provided some water exchange in Pond 3, it is also located very close to the siphon leading from Pond 3 to Pond 4 and, it was feared that as ~~if~~ it widend~~s~~, it could undermine the siphon, leading to a possible release from Pond 4. DFG therefore~~subsequently~~ obtained an emergency exemption to create a small 2-foot-wide ditch on the southeast side of Pond 3 to take the pressure off of the ditch on South Slough by facilitating some circulation of water in and out of Pond 3. ~~USGS is currently monitoring salinity within and outside the small ditches. Initial findings indicate that the small amount of tidal exchange that occurs through these ditches has a negligible effect on water quality in the adjacent sloughs (Schoellhamer pers. comm.).~~

Initially, salinity increases in South Slough were limited to a localized area near the original breach. In Pond 3, the water level rose because of tidal pumping, which altered salinity, temperature, dissolved oxygen (DO) and pH. However, the breaches' effects on the pond were limited until mid-December (December 13–20, 2002) when the combination of a large storm and high tides widened the breach to South Slough. Within 1 week of the storm, rainfall and increased tidal action lowered the salinity of the pond from 45 ppt to 20 ppt, the background level in the Napa River. There was no detectable increase in salinity downstream of the breaches in Mare Island Strait or in Carquinez Strait. However, a salinity pulse persisting for 10 days was detected on the edge of a barotropic convergence zone 6 km to the west of the South Slough breach, about halfway between the Napa River and Sonoma Creek. Because of dilution by slough water and continuing rain, the salinity at this location never exceeded 20 (which is equivalent to ambient summer conditions). (Schoellhamer pers. comm.)

The breach to South Slough has continued to widen to over 70 feet, and a scour hole as much as 26 feet deep and 150 feet long has formed in the slough to the east of the breach. The scour hole predominantly migrates eastward because flow rates east of the South Slough breach increased to as much as 160 m3/s (more than twice the flow rate than west of the breach) to accommodate the tidal prism of Pond 3. In Pond 3, borrow ditches and relict channels near the breach also have been scoured by this increased flow. Minimal erosion has occurred at the second breach at Dutchman Slough, and water exchanges at this location are minimal because the thalweg of this breach is higher than that of the breach to South Slough. (Schoellhamer pers. comm.)

S.5.2 Salinity Reduction Options

Salinity reduction is the first step in the habitat restoration process. Currently, many of the ponds have salinities that either preclude use of the ponds by wildlife, or limit use of the ponds to a very small number of species seasonally. Reducing the salinities in the ponds to a level that makes the ponds usable for a

wide range of wildlife would be the first step in enhancing the habitat value of the ponds. Generally, once the ponds are desalinated, they could be opened up to tidal action or maintained as managed ponds.

Salinity reduction is not currently required for Ponds 1, 1A, 2, and 2A. Ponds 1, 1A, and 2 all have salinities that are at or near ambient conditions (i.e., salinity levels near San Pablo Bay/Napa River levels), and Pond 2A has been restored to tidal marsh. Ponds 1, 1A, and 2 have water exchange (i.e., they can continue to function as ponds in the long term without salinity build-up in the ponds).

All salinity reduction options would use the existing water conveyance infrastructure to the degree possible. However, the existing water conveyance structures are deteriorated, and the engineering evaluation suggests that all siphons would require refurbishing or replacement. In addition, all three options require construction and/or repair of intakes, outfalls, and other water conveyance structures (such as pumps, siphons, weirs, and fish screens).

Levee repairs would be conducted at the start of the desalination period for those ponds requiring desalination. The amount of repairs required depends on the desalination option selected, because different ponds would be desalinated at different rates under the different options (i.e., the duration for which the levees would have to retain their integrity, and which levees are required to retain their integrity, vary by option). For ponds that require a long time for desalination (e.g., Pond 7), levee maintenance would be required before and during the desalination period. It is estimated that 5% of all levees would require repairs every year.

S.5.2.1 Salinity Reduction Option 1: Napa River and Napa Slough Discharge

Under this option, salinity reduction in the lower ponds (3, 4/5, and 6/6A) would be achieved through a phased approach: restoration to near ambient Napa River salinity levels would begin at Pond 3, then continue to Ponds 4/5, and then to Ponds 6/6A. Primary discharges from the lower ponds would be to the Napa River. Salinity reduction in the upper ponds (7, 7A, and 8) would be carried out in a parallel phase. Primary discharges from the upper ponds would be to Napa Slough.

With a phased salinity reduction process, each pond would achieve full habitat value as soon as possible. Ponds that are slated to remain managed ponds would be fully functioning habitat as soon as salinity reduction is completed. Each of the ponds that is slated to be opened up to tidal action could be opened up to tidal action as soon as its salinity and water quality parameters are in the appropriate range as determined by the San Francisco Bay Regional Water Quality Control Board (RWQCB) and other regulatory agencies.

One of the concerns associated with existing conditions at the Napa River Unit is that one or more of the pond levees could breach and that that breach would

result in an uncontrolled release of saline brine. However, controlled, managed breaches into the Napa River, especially for the less saline ponds, represent a potentially effective means of desalinating some of the ponds. The goal of the breaches proposed under this scenario would be to desalinate the ponds. Additional breaches would be added to allow full tidal exchange and return the ponds to tidal habitats.

The portion of the Napa River adjacent to Ponds 3 and 4/5 experiences a significant daily tidal flow, which would result in a high dilution rate for brines discharged in this area. Modeling has shown that controlled breaches for the lower ponds can be an effective means of desalinating these ponds.

Consequently, Salinity Reduction Option 1 has three suboptions: Option 1A, "Napa River and Napa Slough Discharge"; Option 1B, "Napa River and Napa Slough Discharge and Breach of Pond 3"; and Option 1C, "Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5" (Figures S-4, S-5, and S-6). The difference between the suboptions is in the way in which desalination of Ponds 3 and 4/5 would be conducted (via constructed intakes and outfalls, or via breaches).

S.5.2.2 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Numerous reverse flow alternatives were considered but eliminated because they would increase desalination time (delay the time at which one or more ponds could be opened to tidal action) and could lead to unacceptably high increases in salinity in the lower ponds, which are already viable habitat. However, reverse flow would allow discharge to San Pablo Bay, which could increase the San Francisco Bay RWQCB's allowable discharge rate for salt (because San Pablo Bay is more saline than the Napa River, has a larger tidal flow, and has much better mixing and dispersion).

This modified reverse-flow option addresses the issue of delay in opening the ponds, as well as controlling the salinity increases in the lower ponds, while still allowing discharge to San Pablo Bay. Under this option (Figure S-7), there would be two components: salinity reduction in Ponds 3, 4, and 5, with discharge to the Napa River; and salinity reduction in Ponds 7, 7A, and 8 via Ponds 1, 1A, 2, and 6/6A, with discharge to San Pablo Bay. Although salinity reduction is not required for Ponds 1, 1A, and 2, water would be discharged to San Pablo Bay through the existing <u>and a new</u> culvert at Pond 1; therefore, this component includes transfer of increased saline water <u>(including diluted bittern)</u> through Ponds 1, 1A, and 2, which are already managed tidal ponds. The salinity reduction process for these two components would occur simultaneously.

S.5.3 Water Delivery Option

In addition to water delivery to the project site by the tidal influence of San Pablo Bay, this option includes the delivery of tertiary recycled water from wastewater treatment plants (WWTPs) in the north bay region. This option (Figures S-8 and S-9) includes a *Water Delivery Project Component* and a *Water Delivery Program Component*:

- *Water Delivery Project Component:* A combined 6,000–7,000 acre-feet (af)/year of tertiary recycled water would be provided from three local WWTPs—the Sonoma Valley County Sanitation District (SVCSD) WWTP, the Napa Sanitation District (NSD) WWTP, and the City of American Canyon (CAC) WWTP—for salinity reduction, and subsequently for agricultural irrigation. This component is considered feasible and therefore is currently a part of the Water Delivery Option.
- *Water Delivery Program Component:* Tertiary recycled water from other reclamation plants in the north bay region could be added to the system at some point in the future assuming the Project Component is implemented.

The impact analyses in Chapters 3–16 of this document are at a project level for the currently proposed concept (Water Delivery Project Component) and at a program level for the potential future phase(s) (Water Delivery Program Component). If specific proposals are made for such future phases, Sonoma County Water Agency (SCWA) would prepare more detailed information. The potential environmental impacts of those future detailed proposals would then be addressed at a project level of analysis through a separate supplemental environmental document.

S.5.4 Habitat Restoration Options

The goal of the project is to provide a mosaic of wetland habitats within the Napa River Unit, including tidal habitats and managed ponds. This mix of habitats would benefit a diversity of wildlife, including special-status species, migratory waterfowl and shorebirds, anadromous and resident fish, and other aquatic animals. All of the habitat restoration alternatives provide a mix of tidal marsh and managed ponds, but vary in the extent of managed ponds restored to full tidal exchange.

Goals for tidal habitat restoration, which would include middle marsh, lower marsh, intertidal mudflat, and subtidal areas, are as follows:

- In a phased approach, restore large patches of tidal marsh that support a wide variety of fish, wildlife, and plants, including special-status species.
- Create connections between the patches of tidal marsh (in the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.

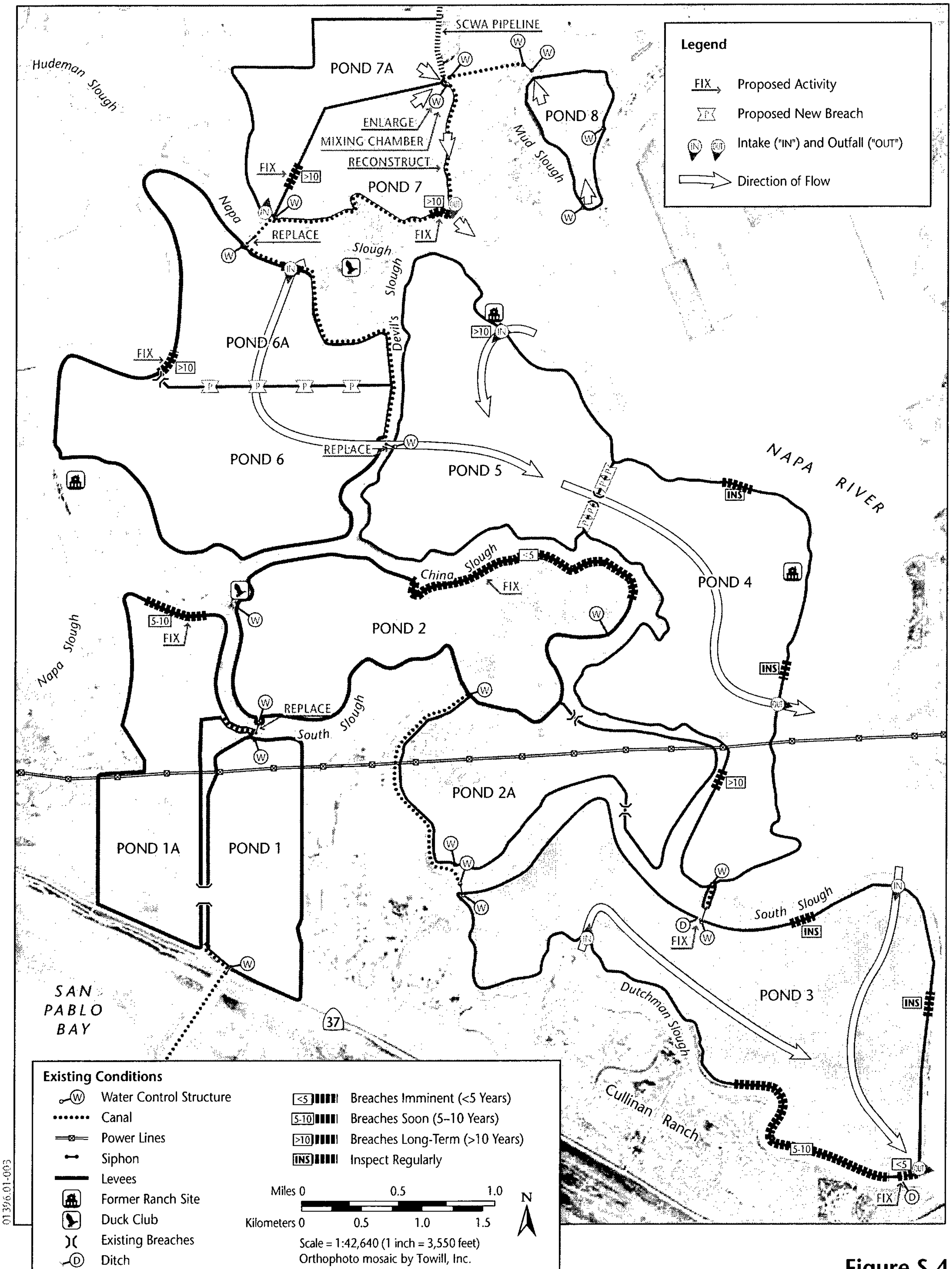

Figure S-4
Salinity Reduction Option 1A:
Napa River and Napa Slough Discharge

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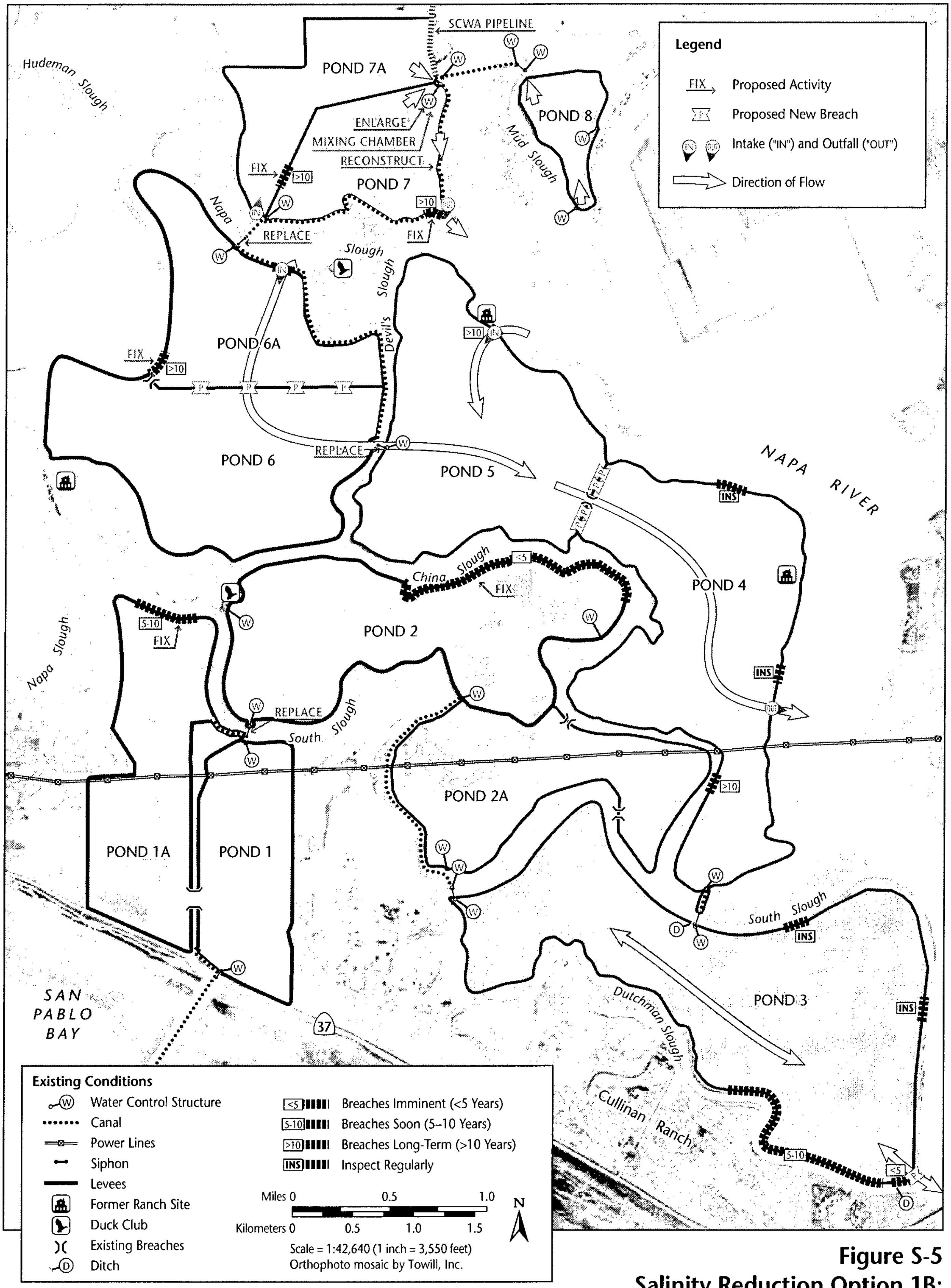

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Figure S-5
Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Jones & Stokes

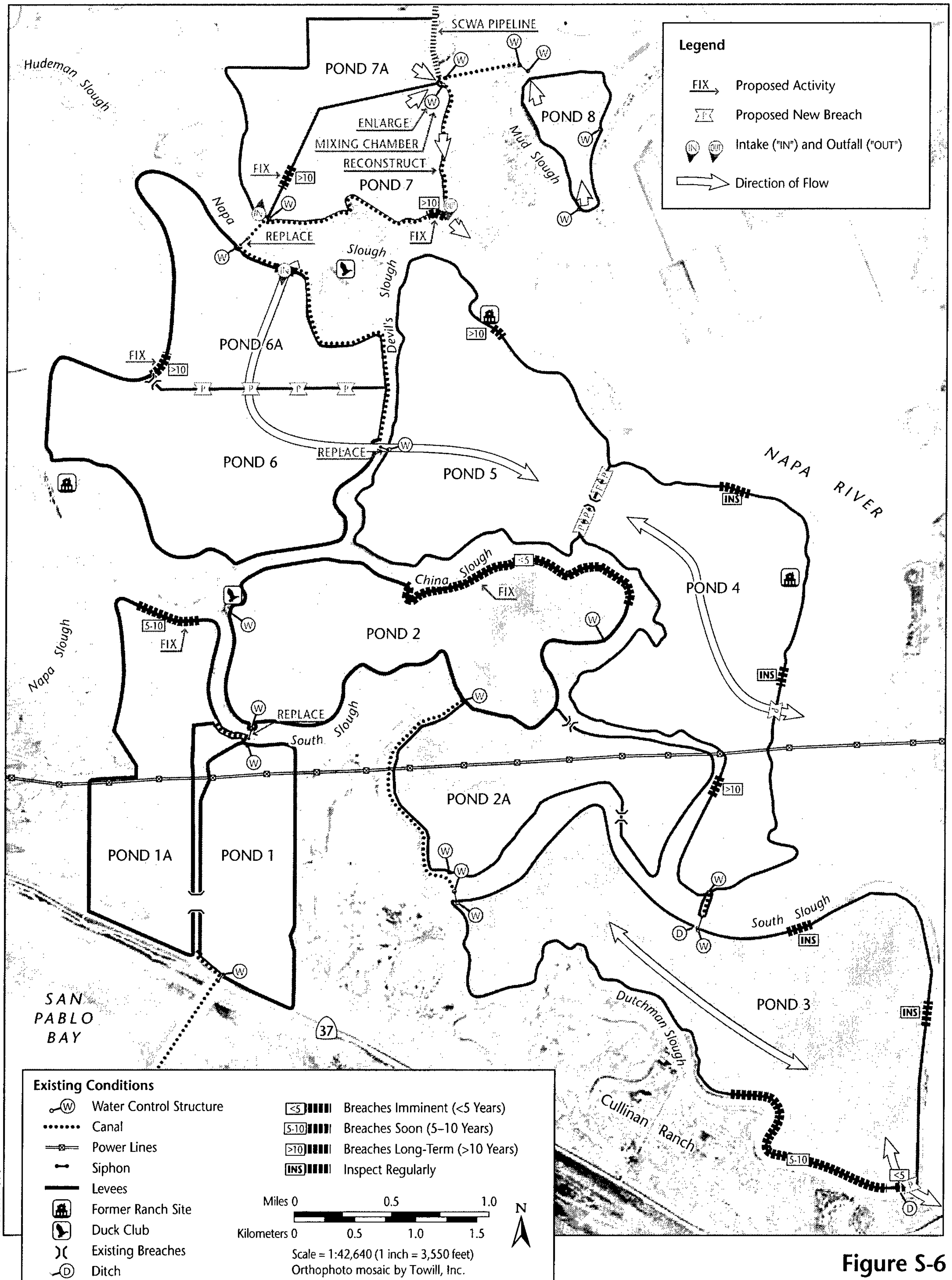

Figure S-6
Salinity Reduction Option 1C:
Napa River and Napa Slough Discharge
with Breaches of Ponds 3 and 4/5

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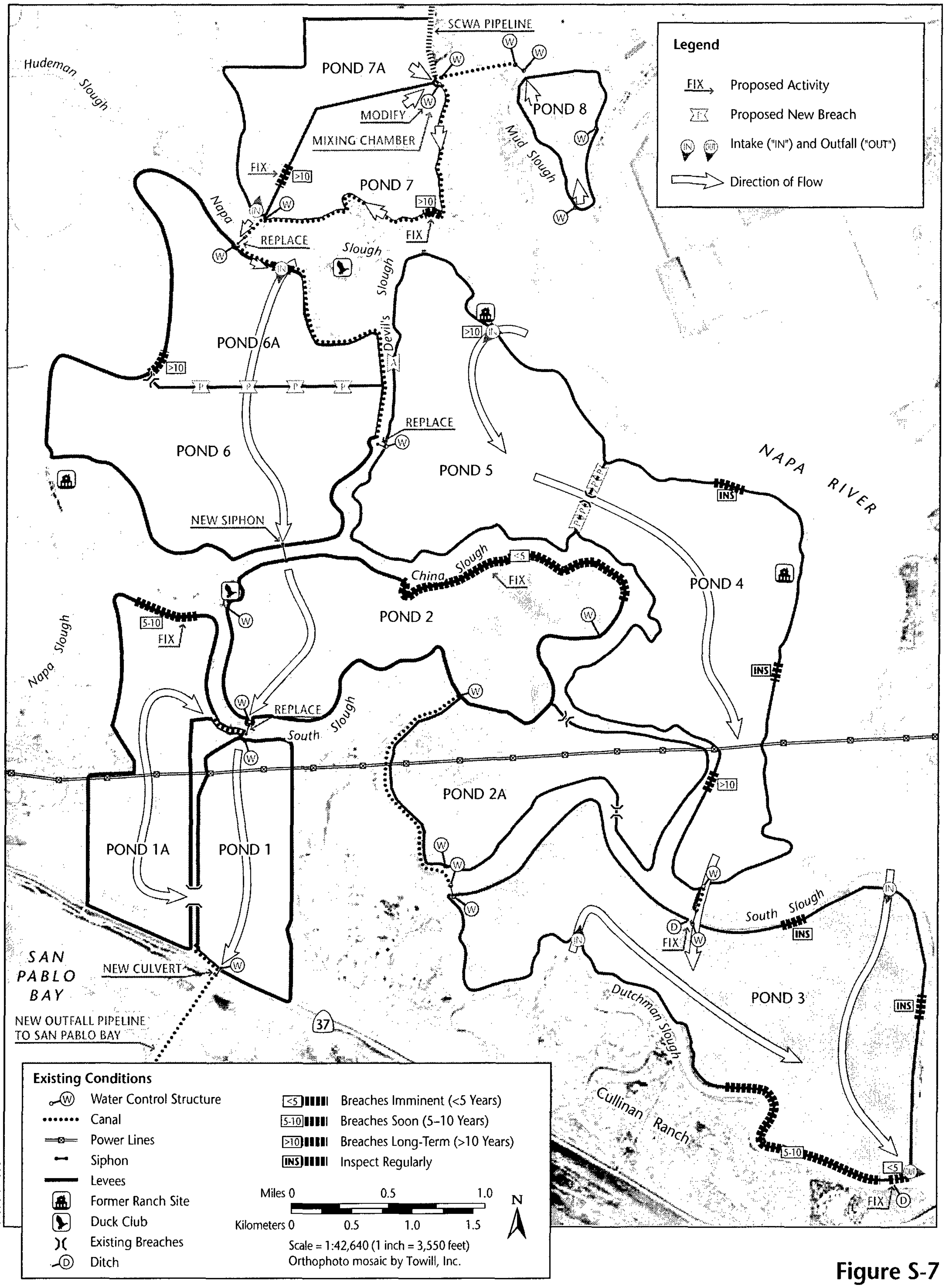

Figure S-7
Salinity Reduction Option 2:
Napa River and San Pablo Bay Discharge

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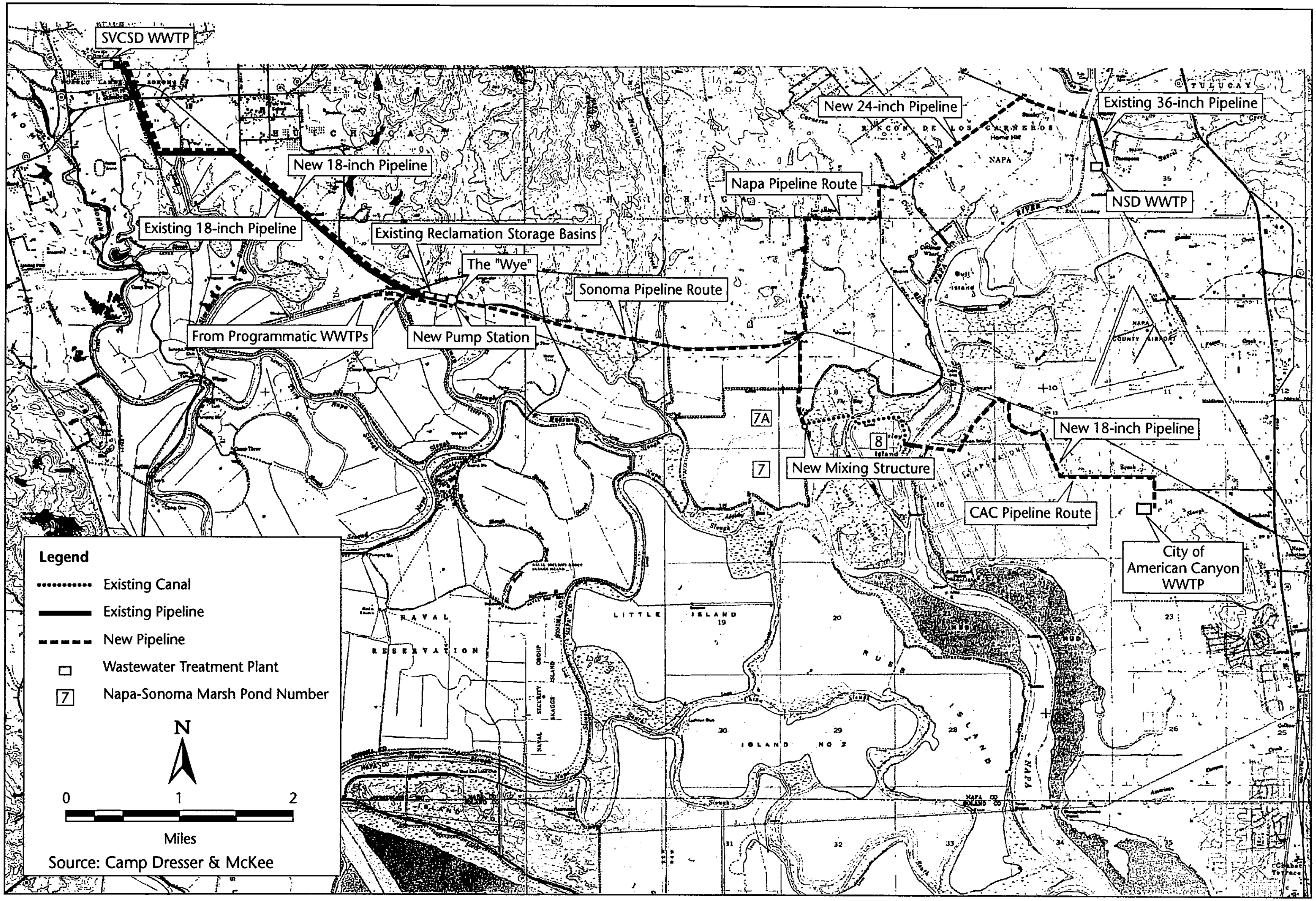

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Figure S-8
Water Delivery Option: Project Component

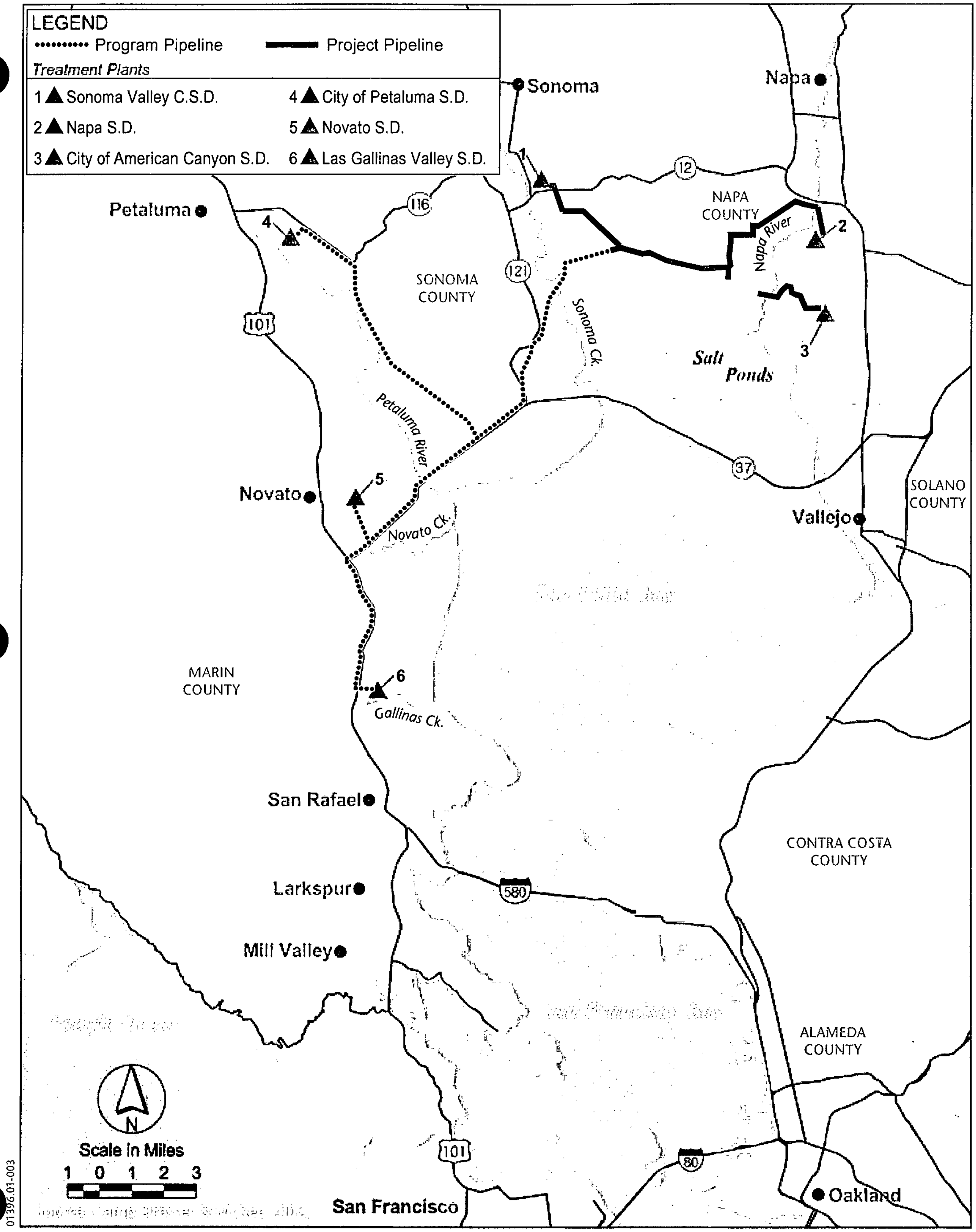

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Figure S-9
Water Delivery Option: Program Component

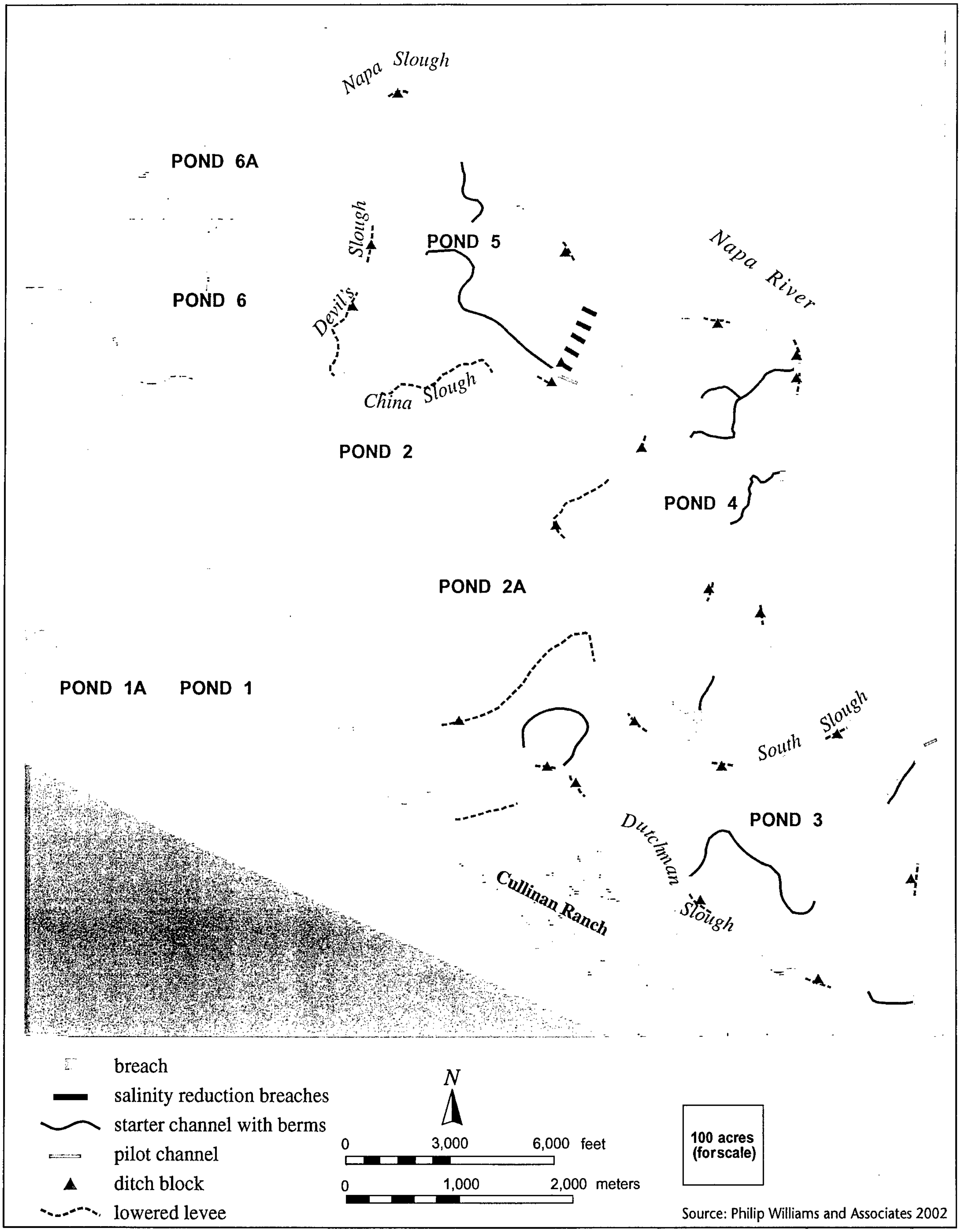

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Figure S-10
Habitat Restoration Option 1:
Mixture of Ponds and Tidal Marsh

- Restore tidal marsh in a band along the Napa River to maximize benefits for fish and other aquatic animals.

More than 7,000 acres of the Napa River Unit consist of inactive salt ponds that were used for salt production through the solar evaporation of bay water. These ponds, both historically and currently, serve as habitat for phytoplankton, invertebrates, fish, waterfowl, and shorebirds.

The habitat restoration options each provide for the continued management of at least five of the 12 ponds as ponds. Project goals for pond habitat are to enable DFG to better and more efficiently control water depth and salinity for the benefit of shorebirds and waterfowl. Waterfowl and shorebird use of the ponds is influenced by the water depth, salinity, and size of each pond. DFG will write a management plan for the Napa River Unit that will provide for pond management in the long term.

Levees and water control structures for all the ponds that would be preserved as ponds would need to be repaired or replaced so that salinity could be reduced in the short term and the water supply could be managed in the long term. The goal would be to maintain both the depth and salinity for a given pond within a specified range. The range would reflect both the needs of different bird species likely to be present in the project area throughout the year, as well as seasonal variations. Water from the Napa River or Napa Slough would be added to ensure that the ponds do not drop below a certain critical depth. Recycled water could also be used to help maintain the levels in the ponds but in the long term would primarily be used for local agriculture.

As described below and in Chapter 2, "Site Description and Alternatives," the various habitat restoration options would evolve over different periods of time and achieve different mixes of habitats.

S.5.4.1 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Habitat Restoration Option 1 provides for a mosaic of tidal habitats and managed ponds (Figure S-10). Under this option, the existing ponds would be managed as follows:

- Ponds 1, 1A, 2, and 2A would be maintained as they are, with levee repair and water control improvements as needed.
- Habitat restoration features, including ditch blocks, levee lowering, and starter channels would be constructed in Pond 3, 4/5, and 6/6A.
- Pond~~s~~ 3 would be opened to tidal action first, followed by Pond~~and~~ 4/5 ~~would be opened to the tidal prism in an orderly manner~~. Levee breaches for habitat restoration would depend on accretion rates and sediment budget.
- Pond 6/6A would be maintained as a managed pond during the initial restoration of Ponds 3 and 4/5, an estimated 10–20 years. Adaptive

management of the project would determine whether Pond 6/6A is converted to tidal marsh or retained as a pond in the long term.

- Ponds 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels. Levees would be repaired and water control improvements would be made as needed.

S.5.4.2 Habitat Restoration Option 2: Tidal Marsh Emphasis

Habitat Restoration Option 2 provides for a mosaic of tidal habitats and managed ponds with an emphasis on tidal habitats (Figure S-11). Under this option, the existing ponds would be managed as follows:

- Ponds 1 and 1A, the western half of Pond 2 (Pond 2W), and Pond 2A would be maintained as they are, with levee repair and water control improvements as needed. A new levee would be built down the middle of Pond 2.
- Habitat restoration features, including ditch blocks, levee lowering, and starter channels would be constructed in Pond 3, 4/5, and 6/6A.
- Ponds 3, 4, 5, 6, and 6A, and the eastern half of Pond 2 (Pond 2E) would be opened to the tidal prism with levee breaches in an orderly manner depending on accretion rates and sediment budget. Design features would be used as needed for improved accretion rates and habitat evolution. Pond 3 would be opened to tidal action first, followed by Ponds 4 and 5, then Ponds 2E, 6, and 6A. Ponds 2E and 6/6A would be maintained as ponds~~, with levee repair and water control improvements as needed,~~ until significant habitat development occurs in Ponds 3, 4, and 5.
- Ponds 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels, with levee repair and water control improvements as needed.

S.5.4.3 Habitat Restoration Option 3: Pond Emphasis

Habitat Restoration Option 3 provides for a mosaic of tidal habitats and managed ponds, with an emphasis on managed ponds (Figure S-12). Under this option, the existing ponds would be managed as follows:

- Ponds 1, 1A, 2, and 2A would be maintained as they are, with levee repair and water control improvements as needed.
- Habitat restoration features, including ditch blocks, levee lowering, and starter channels would be constructed in Pond 3, 4/5, and 6/6A.
- Ponds 3 and 4 would be opened to the tidal prism with levee breaches in an orderly manner depending on accretion rates and sediment budget. Pond 3 would be opened to tidal action first, followed by Pond 4.

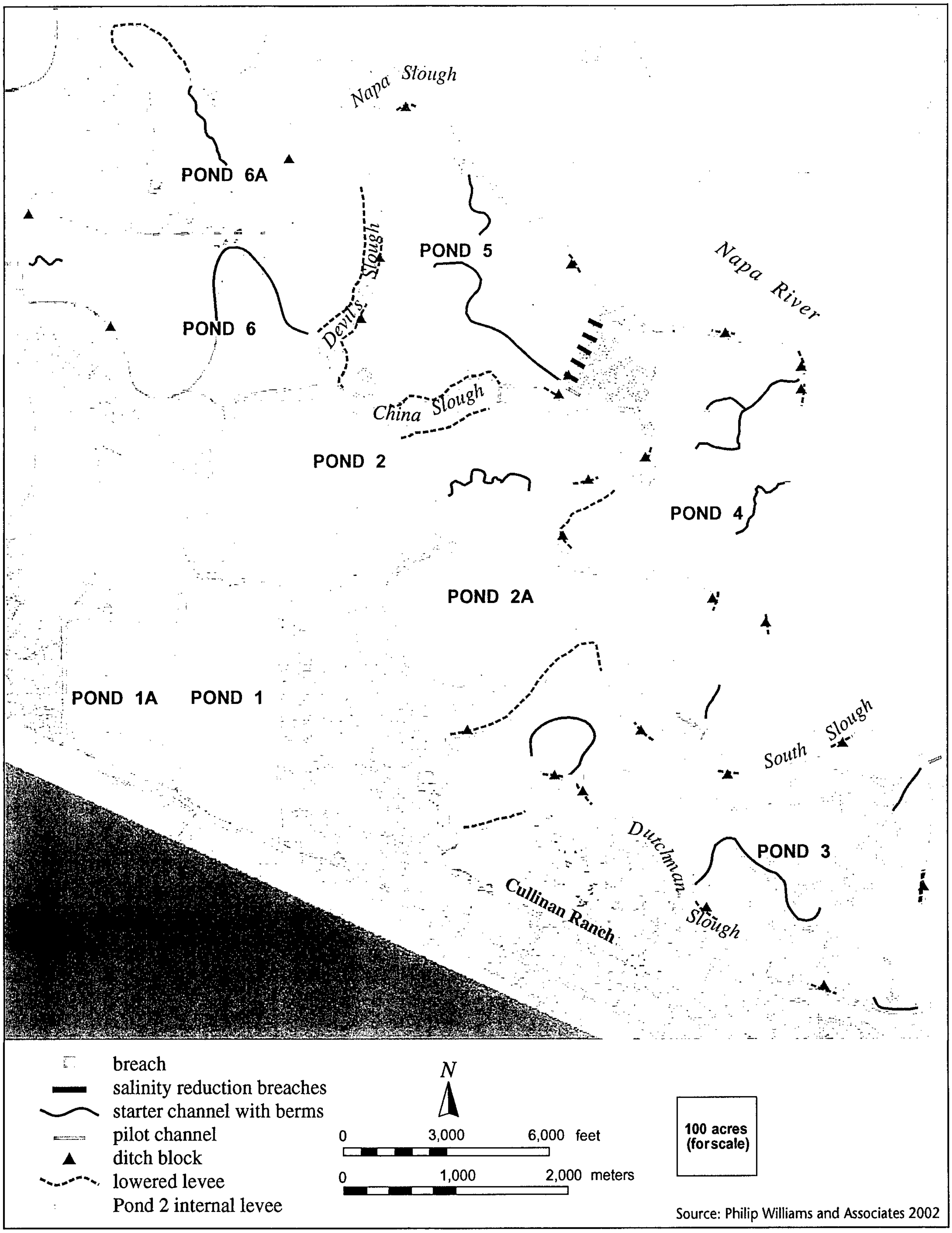

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Figure S-11
Habitat Restoration Option 2: Tidal Marsh Emphasis

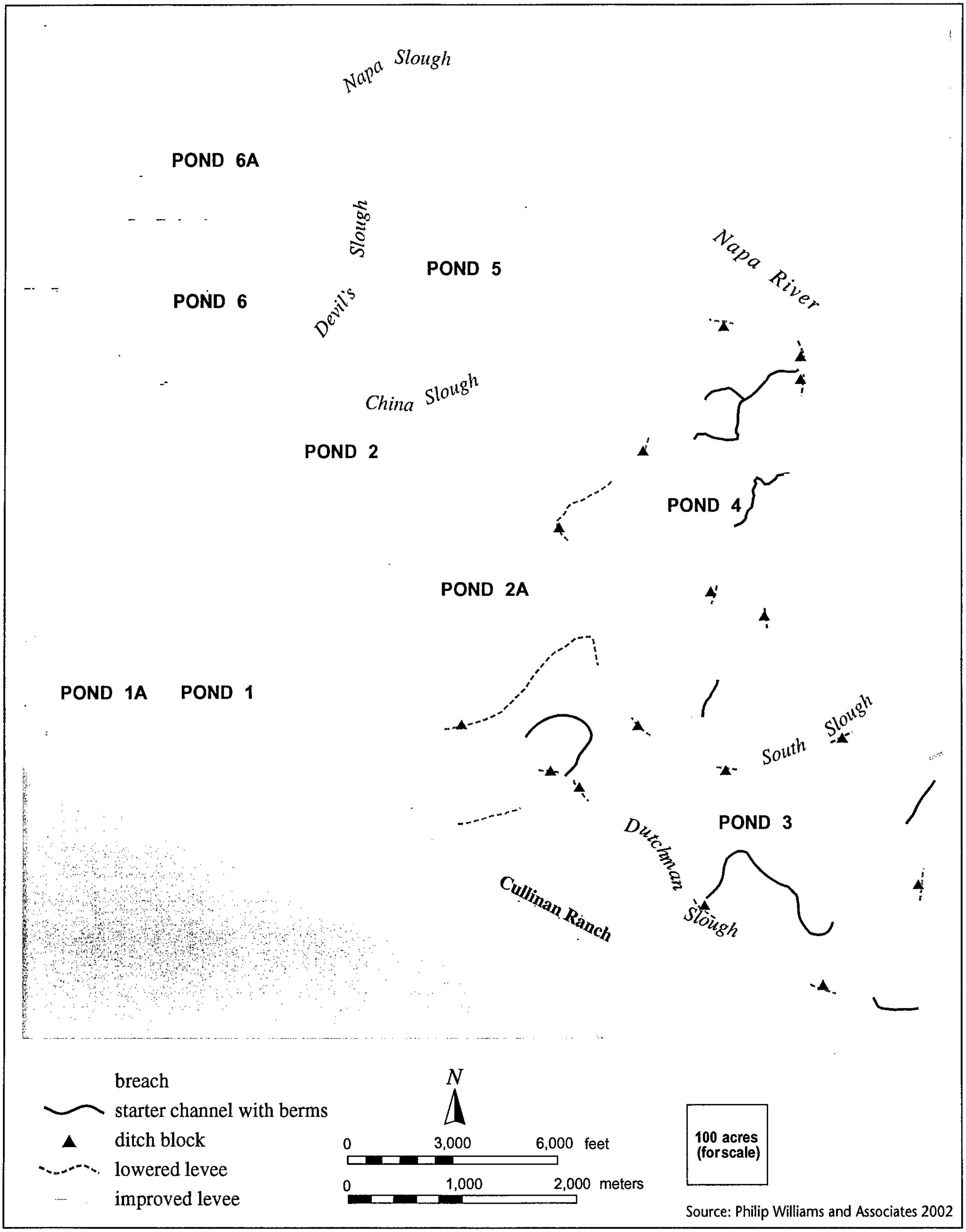

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Figure S-12
Habitat Restoration Option 3:
Pond Emphasis

- Ponds 5, 6, 6A, 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels, with the Pond 4/5 levee being repaired following salinity reduction, and other levee repairs and water control improvements as needed.

S.5.4.4 Habitat Restoration Option 4: Accelerated Restoration

Habitat Restoration Option 4 is identical to Habitat Restoration Option 1 in terms of the habitat mix; however, more extensive construction activities would occur at the ponds opened to tidal action. The additional construction activities, described below, are intended to accelerate marsh evolution (Figure S-13). The managed ponds (Ponds 1, 1A, 2, 7, 7A, and 8) would be constructed and operated in the same way as for Habitat Restoration Option 1.

- **Fill 100 Acres of Pond 4 (or a Similar Location).** Clean and local sediment would be placed in the southern portion of Pond 4, or a similar location with low historic slough channel density, to raise the pond elevation to within 1 foot of MHHW. This limited fill placement would speed initial vegetative colonization by raising the initial elevation of the site. This fill would help compensate for the anticipated temporary reduction in fringing marsh.
- **Number and Length of Starter Channels.** The total length of starter channels and associated berms would increase from 27,500 feet to 55,300 feet. The increased number and length of starter channels would increase the channelization within the marsh, and sediment transport into the interiors of the ponds. The increased amount of berms would provide more wave breaks, more sacrificial sediment sources, and more opportunities for early colonization by marsh vegetation.

The addition of these more extensive design features could accelerate the habitat evolution compared to the other habitat restoration options. The number of breaches and ditch blocks and the amount of levee lowering would be the same as under Habitat Restoration Option 1.

S.6 Comparison of Options

A summary of impacts associated with each option and the level of significance and mitigation measures for each is contained in Tables S-1 and S-2.

S.7 Identification of Alternatives

Based on a detailed option and alternative screening process, the following nine alternatives were included for detailed analysis:

- No-Project Alternative;

- Alternative 1: Napa River and Napa Slough Discharge (Salinity Reduction Option 1A), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 2: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 3: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Tidal Marsh Emphasis (Habitat Restoration Option 2);
- Alternative 4: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Pond Emphasis (Habitat Restoration Option 3);
- Alternative 5: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4);
- Alternative 6: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5 (Salinity Reduction Option 1C), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 7: Napa River and San Pablo Bay Discharge and Breach of Pond 3 (slight modification of Salinity Reduction Option 2), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4); and
- Alternative 8: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), No Recycled Water, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1).

S.8 Comparison of Alternatives

A summary of the significant impacts associated with each of the alternatives, and the level of significance and mitigation measures for each, is contained in Table S-3. A summary of beneficial impacts associated with each alternative is contained in Table S-4.

S.9 Impact Conclusions

S.9.1 Environmentally Superior Alternative

The environmentally superior alternative is the alternative that would cause the least damage to the biological and physical environment and that would protect, preserve, and enhance the historical, cultural, and natural resources of the project area. As the proposed project is a restoration project, all alternatives, by definition, would benefit the biological and physical environment and are designed to enhance the natural resources in the project area. However,

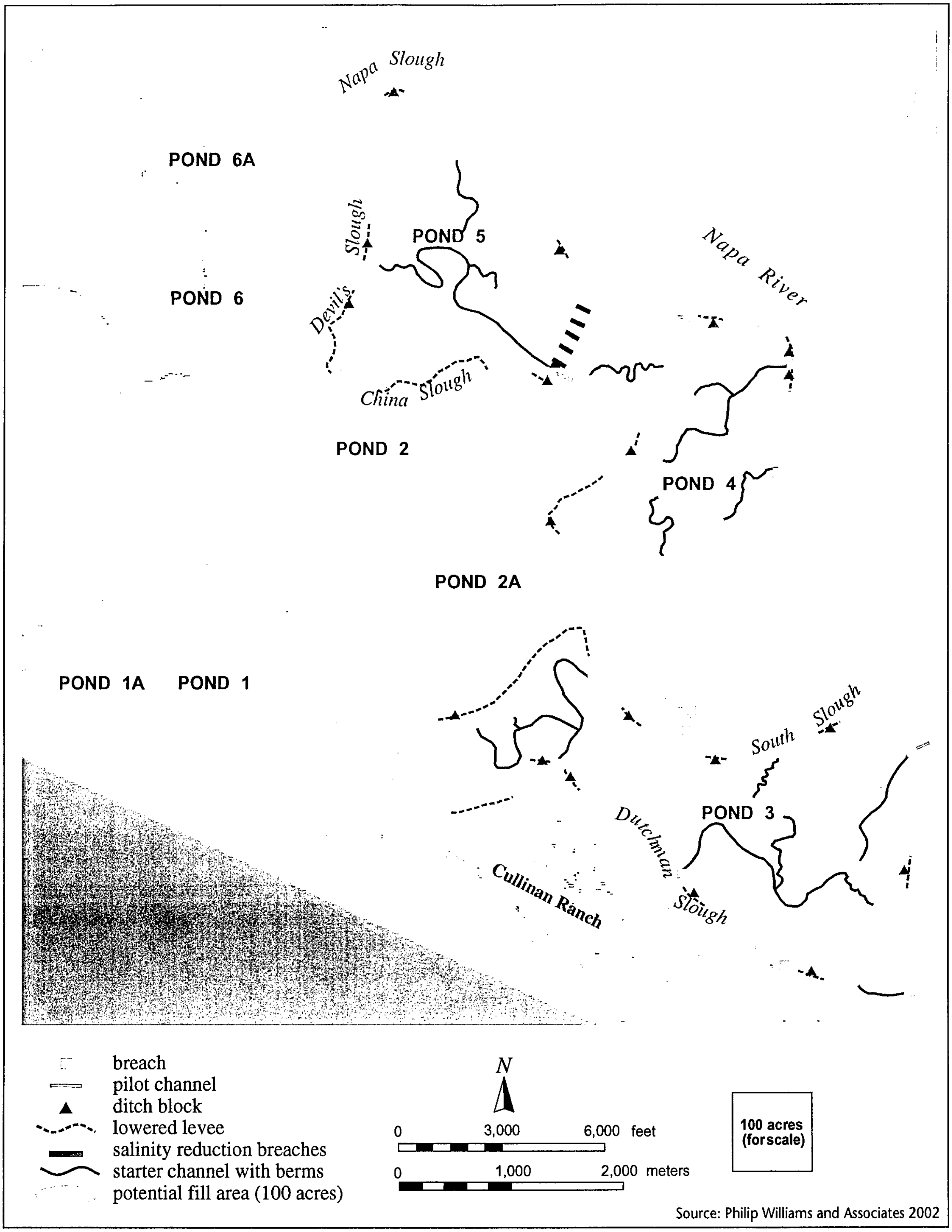

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Figure S-13
Habitat Restoration Option 4: Accelerated Restoration

Table S-1. Summary Comparison of Impacts and Mitigation Measures for the Napa River Salt Marsh Project: No-Impact Alternative, Salinity Reduction Options, and Water Delivery Option

	Impact Level by Alternative/Option					
Resources, Impacts, and Mitigation Measures*	**No-Project**	**SRO 1A**	**SRO 1B**	**SRO 1C**	**SRO 2**	**Water Delivery Option**
Hydrology						
H-1: Reduced Risk of Property Damage, Injury, or Death as a Result of Flooding	NA	***B***	***B***	***B***	***B***	NA
H-2: Modification of Surface Drainage Patterns Mitigation: Measure H-2 (Avoid Drainage Pattern Alteration in Plans for Future Pipeline Alignments) *(Water Delivery Program Component only)*	NA	LTS	LTS	LTS	LTS	*Project Component:* LTS *Program Component:* S
H-3: Increased Risk of Property Damage, Injury, or Death as a Result of Flooding Mitigation: Measure H-1 (Repair Unintended Levee Breaches)	NA	NA	S	S	NA	NA
H-4: Alteration of Groundwater Supplies or Recharge Patterns	NA	NA	NA	NA	NA	LTS
Water Quality						
WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water	S*	NA	NA	NA	NA	NA
WQ-2: Short-Term Construction-Related Water Quality Impacts *(All SROs)* Mitigation: Measure WQ-1 (Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices) *(SROs 1B / 1C)* Mitigation: Measure WQ-5 (Prepare Levees and Time Breaches) *(Water Delivery Option)* Mitigation: Measure WQ-6 (Prepare and Implement Storm Water Pollution Prevention Plans)	NA	S	S	S	S	S
WQ-3: Increase in Salinity in the Napa River Mitigation: Measure WQ-2 (Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring)	NA	S	S	S	S	NA
WQ-4: Increase in Conventional and Toxic Constituents Mitigation: Measure WQ-2 (see above)	NA	S	S	S	S	NA
WQ-5: Discharges of Priority Heavy Metal and Organic Constituents in the Napa River and Local Sloughs Mitigation: Measure WQ-2 (see above)	NA	S	S	S	S	NA

Key: SRO = Salinity Reduction Option; NA = Not Applicable.
Significance determinations: B = Beneficial, NI = No Impact, LTS = Less than Significant, S = Significant, SU = Significant and Unavoidable. (Beneficial impacts are shown in ***bold italic***.)
* All significant impacts are reduced to a less-than-significant level with mitigation unless the impact is listed as Significant and Unavoidable (SU) or is listed under the No-Project Alternative (because this alternative would result in no project being implemented, no mitigation is proposed if this occurs).

Table S-1. Continued

	Impact Level by Alternative/Option					
Resources, Impacts, and Mitigation Measures*	**No-Project**	**SRO 1A**	**SRO 1B**	**SRO 1C**	**SRO 2**	**Water Delivery Option**
Water Quality (continued)						
WQ-6: Increase in Contribution of Conventional Heavy Metal and Organic Constituents from Recycled Water Mitigation: Measure WQ-3 (Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements)	NA	S	S	S	S	NA
WQ-7: Water Quality Changes in the Salt Ponds Mitigation: Measure WQ-4 (Monitor Pond Water Quality and Use Adaptive Management)	NA	S	S	S	S	NA
WQ-8: Long-Term Changes to Water Quality in Local Rivers and Salt Ponds from Project Operations	NA	NA	NA	NA	NA	*Project Component:* B *Program Component:* LTS
Biological Resources—Vegetation						
V-1: Loss of Common and Sensitive Vegetation Communities and Special-Status Plants as a Result of Levee Failure and Emergency Repairs	LTS	NA	NA	NA	NA	NA
V-2: Temporary Alteration of Common Vegetation and Sensitive Communities *(Water Delivery Option only)* Mitigation: Measure V-2 (Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures)	NA	LTS	LTS	LTS	LTS	S
V-3: Removal of Soft Bird's-Beak Mitigation: Measure V-1 (Avoid Ground Disturbance in Populations of Soft Bird's-Beak)	NA	S	S	S	S	NA
V-4: Removal of Other Special-Status Species	NA	LTS	LTS	LTS	LTS	NA
Biological Resources—Wildlife						
W-1: Long-Term Decline in Habitat Value and Function	S*	NA	NA	NA	NA	NA
W-2: Temporary Disturbance of Wildlife	S*	NA	NA	NA	NA	NA

Key: SRO = Salinity Reduction Option; NA = Not Applicable.
Significance determinations: B = Beneficial, NI = No Impact, LTS = Less than Significant, S = Significant, SU = Significant and Unavoidable. (Beneficial impacts are shown in ***bold italic***.)
* All significant impacts are reduced to a less-than-significant level with mitigation unless the impact is listed as Significant and Unavoidable (SU) or is listed under the No-Project Alternative (because this alternative would result in no project being implemented, no mitigation is proposed if this occurs).

Table S-1. Continued

Resources, Impacts, and Mitigation Measures*		Impact Level by Alternative/Option No-Project	SRO 1A	SRO 1B	SRO 1C	SRO 2	Water Delivery Option
Biological Resources—Wildlife (continued)							
W-3:	Construction-Related Disturbance and Mortality of Special-Status Species *(All SROs)* Mitigation: Measure W-1 (Avoid Construction Activities near Nesting Habitats during Breeding Season) *(Water Delivery Project and Program Components).* Mitigation: Measures W-4 (Complete Focused Surveys for Special-Status Wildlife Species before Construction), W-5 (Educate Construction Crews regarding Special-Status Wildlife Species), W-6 (Use Trenchless Construction Techniques for Special-Status Wildlife Species Protection), and W-7 (Restore Habitat Modified by Construction) *(Impact would not be reduced to LTS for work under the Program Component.)*	NA	S	S	S	S	*Project Component:* S *Program Component:* SU
W-4:	Construction-Related Disturbance and Mortality of Salt Marsh Harvest Mouse and Suisun Ornate Shrew Mitigation: Measures W-2 (Avoid Construction Activities near Occupied Suisun Ornate Shrew Habitat or Remove Shrews) and W-3 (Avoid Construction Activities near Occupied Salt Marsh Harvest House Habitat)	NA	S	S	S	S	NA
W-5:	Exposure of Wildlife to Contaminants during Construction Mitigation: Measure WQ-1 (see "Water Quality" above)	NA	S	S	S	S	NA
W-6:	Interference with the Movement of Wildlife Mitigation: Measure W-4 (Complete Wildlife Surveys before Construction)	NA	NA	NA	NA	NA	*Project Component:* LTS *Program Component:* S
Biological Resources—Aquatic Resources							
A-1:	Reduced Water Quality as a Result of Uncontrolled Breaches of Levees	S*	NA	NA	NA	NA	NA
A-2:	Reduced Water Quality during Construction Activities	LTS	NA	NA	NA	NA	NA
A-3:	Disturbance of Substrate and Associated Benthic Organisms during Repair of Levee Breaches	LTS	NA	NA	NA	NA	NA
A-4:	Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs	S*	NA	NA	NA	NA	NA

Key: SRO = Salinity Reduction Option; NA = Not Applicable.
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Resources, Impacts, and Mitigation Measures*	No-Project	SRO 1A	SRO 1B	SRO 1C	SRO 2	Water Delivery Option
	Impact Level by Alternative/Option					
Biological Resources—Aquatic Resources (continued)						
A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds Mitigation: Measure A-1 (Minimize Entrainment of Sensitive Species) *(does not apply to No-Project Alternative)*	S*	S	S	S	S	NA
A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities *(SROs 1A / 2)* Mitigation: Measure A-2 (Install Cofferdams to Minimize In-Water Construction) *(SROs 1B / 1C)* Mitigation: Measure WQ-1 (see "Water Quality" above) *(Water Delivery Program Component)* Mitigation: Measure A-4 (Use Trenchless Technology during Construction to Protect Aquatic Species)	NA	S	S	S	S	*Project Component:* LTS *Program Component:* S
A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality *(SROs 1A / 1B / 1C)* Mitigation: Measures WQ-2, WQ-3, and WQ-4 (see "Water Quality" above) and A-3 (Assess and Maintain Salinity Levels Protective of Aquatic Resources) *(SRO 2)* Mitigation: Measure A-3 (see above)	NA	S	S	S	S	NA
A-8: Disturbance of Substrate and Associated Benthic Organisms during Construction Activities	NA	LTS	LTS	LTS	LTS	NA
A-9: Substantial Interference with the Movement or Migration of Fish Species Mitigation: Measure A-4 (see above)	NA	NA	NA	NA	NA	*Project Component:* LTS *Program Component:* S
Geology and Soils						
Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking	S*	LTS	LTS	LTS	LTS	NA
Geo-2: Levee Failure as a Result of Erosion	S*	NA	NA	NA	NA	NA
Geo-3: Levee Failure or Structural Damage as a Result of a Rupture of a Known Earthquake Fault	NA	LTS	LTS	LTS	LTS	NA

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Table S-1. Continued

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option: No-Project	SRO 1A	SRO 1B	SRO 1C	SRO 2	Water Delivery Option
Geology and Soils (continued)						
Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils *(Water Delivery Option only)*: Mitigation: Measure Geo-2 (Remove Unstable or Expansive Soils and Backfill with Engineered Fill)	NA	LTS	LTS	LTS	LTS	S
Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils *(Water Delivery Option only)*: Mitigation: Measure Geo-2 (see above)	NA	LTS	LTS	LTS	LTS	S
Geo-6: Flooding of the Project Area as a Result of Tsunamis	NA	LTS	LTS	LTS	LTS	NA
Geo-7: Potential Erosion as a Result of Excess Pond Water Height Mitigation: Measure Geo-1 (Maintain Water Level 2 Feet below Levee Crest)	NA	S	S	S	S	NA
Geo-8: Potential Erosion as a Result of Increased Tidal Prism Mitigation: Measure H-1 (see "Hydrology" above)	NA	NA	S	S	NA	NA
Geo-9: Exposure of People or Structures to Potential Adverse Effects as a Result of Fault Rupture, Ground Shaking, or Ground Failure	NA	NA	NA	NA	NA	LTS
Geo-10: Substantial Soil Erosion or Loss of Topsoil	NA	NA	NA	NA	NA	LTS
Hazards and Hazardous Materials						
Haz-1: Potential Release of Bittern or Highly Saline Brines into the Environment as a Result of Uncontrolled Levee Breaching	S*	NA	NA	NA	NA	NA
Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities Mitigation: Measure Haz-1 (Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation)	LTS	S	S	S	S	S~~NA~~
Haz-3: Potential Releases of Irritant Dust from Desiccated Ponds	LTS	NA	NA	NA	NA	NA
Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees Mitigation: Measure Haz-2 (Employ Explosives Experts when Breaching Levees)	NA	S	S	S	S	NA
Haz-5: Potential Releases of Irritant Dust as a Result of Construction Activities Mitigation: Measures Haz-3 (Develop and Implement a Health and Safety Plan) and Haz-4 (Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8)	NA	S	S	S	S	NA

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Table S-1. Continued

	Impact Level by Alternative/Option					
Resources, Impacts, and Mitigation Measures*	**No-Project**	**SRO 1A**	**SRO 1B**	**SRO 1C**	**SRO 2**	**Water Delivery Option**
Hazards and Hazardous Materials (continued)						
Haz-6: Accidental Breaching of Exterior Levees on Highly Saline/Bittern Ponds as a Result of Construction Activities	NA	LTS	LTS	LTS	LTS	NA
Haz-7: Hazard Resulting from the Routine Transport, Use, or Disposal of Hazardous Materials	NA	NA	NA	NA	NA	LTS
Haz-8: Hazard Created through Reasonably Foreseeable Upset and Accident Conditions Involving Release of Hazardous Materials	NA	NA	NA	NA	NA	LTS
Haz-9: Exposures Resulting from Exceeding Human Health Criteria Mitigation: Measure Haz-5 (Prepare and Implement a Safety Plan)	NA	NA	NA	NA	NA	S
Haz-10: Safety Hazard Resulting from Proximity to an Airport	NA	NA	NA	NA	NA	*Project Component:* Sonoma Pipeline, NI; CAC Pipelines, LTS *Program Component:* LTS
Transportation and Circulation						
T-1: Temporary Increase in Traffic Volumes as a Result of Emergency Repairs	LTS	NA	NA	NA	NA	NA
T-2: Temporary Increase in Traffic Volumes as a Result of Project Construction	NA	LTS	LTS	LTS	LTS	LTS
T-3: Increase in Construction-Related Traffic Hazards *(Project Component / Sonoma Pipeline and railroad ROW)* Mitigation: Measure T-1 (Implement Safety Plan for Pipeline Construction along Rail Line) *(Project Component / CAC Pipeline and Green Island Road)* Mitigation: Measure T-2 (Implement Safety Plan for Construction along Public Roads) *(Program Component)* Mitigation: Measures T-1 and T-2 (see above)	NA	LTS	LTS	LTS	LTS	*Project Component:* Sonoma Pipeline / railroad ROW, S; Sonoma Pipeline/ Napa River Unit access road, LTS; CAC Pipeline / Green Island Road, SU; Napa Pipeline/Buchli Station Road, SU *Program Component:* S
T-4: Increase in Watercraft Traffic in the Napa River	NA	LTS	LTS	LTS	LTS	NA
T-5: Individual or Cumulative Exceedance of an Established Level-of-Service Standard	NA	NA	NA	NA	NA	LTS
Air Quality						

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	Impact Level by Alternative/Option					
Resources, Impacts, and Mitigation Measures*	**No-Project**	**SRO 1A**	**SRO 1B**	**SRO 1C**	**SRO 2**	**Water Delivery Option**
AQ-1: Increase in Fugitive Dust Emissions Resulting from Increased Desiccation of the Ponds	LTS	NA	NA	NA	NA	NA
AQ-2: Increase in Ambient Pollutant Levels	NA	LTS	LTS	LTS	LTS	LTS
AQ-3: Potential Releases of Irritant Dust as a Result of Construction Activities Mitigation: Measures AQ-1 (Minimize Dust Generation in and Implement Dust Control Measures for Work Areas with Salt Crusts) and Haz-4 and Haz-5 (see "Hazards and Hazardous Materials" above)	NA	S	S	S	S	NA
AQ-4: Public Exposure to Substantial Pollutant Concentrations	NA	NA	NA	NA	NA	LTS
Noise						
N-1: Temporary Increase in Ambient Noise Levels as a Result of Emergency Repairs	S*	NA	NA	NA	NA	NA
N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction Mitigation: Measure N-1 (Decrease Noise Levels with Use of Noise Reduction Devices) *(Water Delivery Option Project Component [Napa and CAC Pipeline only] and Program Component impact would not be reduced to LTS)*	NA	LTS	LTS	LTS	LTS	*Project Component:* Sonoma Pipeline, LTS; Napa Pipeline, SU; CAC Pipeline, SU *Program Component:* S
N-3: Temporary Increase in Noise Levels as a Result of Blasting Activities	NA	LTS	LTS	LTS	LTS	NA
N-4: Exposure of People to Excessive Ground Vibration	NA	NA	NA	NA	NA	LTS
Land Use and Planning						
LU-1: Compatibility with Land Use Goals and Objectives Mitigation: Measure N-1 (see "Noise" above)	NA	LTS	LTS	LTS	LTS	*Project Component:* Sonoma Pipeline, LTS; Napa and CAC Pipelines, SU (noise only) *Program Component:* SU (noise only)
LU-2: Consistency with Existing or Planned Land Uses	NA	LTS	LTS	LTS	LTS	NA

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Table S-1. Continued

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option: No-Project	SRO 1A	SRO 1B	SRO 1C	SRO 2	Water Delivery Option
Public Services and Utilities						
PS-1: Conflict with Existing Utilities	LTS	LTS	NA	NA	LTS	NA
PS-2: Increased Risk of Instability of Power Towers Mitigation: Measure PS-1 (Ensure the Stability of the Power Towers)	NA	NA	S	S	NA	NA
Recreation, Public Access, Visual Resources, and Public Health						
R-1: Enhanced Recreational Opportunities	NA	***B***	***B***	***B***	***B***	NA
R-2: Consistency with Existing or Proposed Public Access Plans	NA	LTS	LTS	LTS	LTS	NA
R-3: Accelerated Physical Deterioration of a Recreational Facility or Adverse Effects from Facility Expansion	NA	LTS	LTS	LTS	LTS	NA
R-4: Temporary Effect of Construction on Public Access	NA	LTS	LTS	LTS	LTS	NA
R-5: Substantial Adverse Effect on a Scenic Vista	NA	LTS	LTS	LTS	LTS	LTS
R-6: Increased Mosquito Production Mitigation: Measure R-1 (Coordinate Project Activities with the Napa County Mosquito Abatement District)	NA	NA	S	S	S	NA
R-7: Conflicts with Existing or Planned Recreational Uses, and Recreation Plans and Policies Mitigation: Measure R-2 (Prepare a Public Access Plan)	NA	NA	NA	NA	NA	*Project Component:* Sonoma and Napa Pipelines, S; CAC Pipeline, NI *Program Component:* S
Cultural Resources						
C-1: Potential to Materially Impair Significant Cultural Resources	NA	LTS	LTS	LTS	LTS	NA
C-2: Potential for Ground-Disturbing Activities to Damage Previously Unidentified Buried Cultural Resources Sites Mitigation: Measure C-1 (Stop Work If Cultural Resources Are Discovered during Ground-Disturbing Activities)	NA	S	S	S	S	NA

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Table S-1. Continued

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option					
	No-Project	SRO 1A	SRO 1B	SRO 1C	SRO 2	Water Delivery Option
Cultural Resources (continued)						
C-3: Potential to Damage Previously Unidentified Human Remains Mitigation: Measure C-2 (Comply with State Laws Pertaining to the Discovery of Human Remains)	NA	S	S	S	S	NA
C-4: Changes in the Significance of a Historic and/or Archaeological Resource *(Project Component)* Mitigation: Measures C-3 (Conduct Archaeological Monitoring of Construction Activities in the Vicinity of CA-NAP-224, C-164, and CA-NAP-230) *(Program Component)* Mitigation: Measure C-4 (Conduct Records Search and Visual Survey)	NA	NA	NA	NA	NA	S
C-5: Disturbance of Human Remains Mitigation: Measure C-2 (see above)	NA	NA	NA	NA	NA	S
Cumulative Impacts						
Cu-1: Cumulative Hydrologic Changes in the Lower Napa River Mitigation: Measure Cu-1 (Implement Monitoring and Adaptive Management Program)	NA	S	S	S	S	NA
Cu-2: Cumulative Adverse Change in Water Quality Mitigation: Measures Cu-1 (see above), WQ-2 (see "Water Quality" above) *(Project and Program Component)* Mitigation: WQ-2 (see "Water Quality" above)	NA	S	S	S	S	S
Cu-3: Cumulative Change in Sensitive Plant Communities	NA	***B***	***B***	***B***	***B***	NA
Cu-4: Increase in Nonnative Smooth Cord Grass Mitigation: Measure V-3 (Monitor and Manage Invasive Exotic Plant Species)	NA	S	S	S	S	NA
Cu-5: Cumulative Reduction in Sensitive Vegetation Species and Their Habitats Mitigation: Measure Cu-2 (Conduct Biological Surveys for Sensitive Biological Resources)	NA	NA	NA	NA	NA	S
Cu-6: Long-Term Increase in Lower and Middle Marsh Habitat Suitable for Special-Status Species	NA	***B***	***B***	***B***	***B***	NA
Cu-7: Loss of Open-Water Habitat for Migratory Shorebirds and Waterfowl	NA	LTS	LTS	LTS	LTS	NA
Cu-8: Cumulative Reduction in Sensitive Wildlife Species and Their Habitats Mitigation: Measure Cu-2 (see above)	NA	NA	NA	NA	NA	S
Cu-9: Increase in Subtidal Habitat	NA	***B***	***B***	***B***	***B***	NA

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Table S-2. Summary Comparison of Impacts and Mitigation Measures for the Napa River Salt Marsh Restoration Project: No-Project Alternative and Habitat Restoration Options

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option				
	No-Project	HRO 1	HRO 2	HRO 3	HRO 4
Hydrology					
H-2: Modification of Surface Drainage Patterns	NA	***B***	***B***	***B***	***B***
H-5: Increased Flood Conveyance Capacity	NA	***B***	***B***	***B***	***B***
H-6: Continued Adjustment of Invert Elevation and Channel Form Near Breached Channel Segments	NA	LTS	LTS	LTS	LTS
H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels Mitigation: Measure H-3 (Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge)	NA	S	S	S	S
H-8: Potential Increase in Flood Risk on Adjacent Properties as a Result of Wave Erosion Mitigation: Measure H-4 (Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed)	NA	S	S	S	S
H-9: Potential Navigation Hazard as a Result of Increased Velocity in Mare Island Strait	NA	LTS	LTS	LTS	LTS
Water Quality					
WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water	S*	NA	NA	NA	NA
WQ-2: Short-Term Construction-Related Water Quality Impacts *(All HROs)* Mitigation: Measures WQ-1 (Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices) *(HROs 1/3)* Mitigation: Measure WQ-5 (Prepare Levees and Time Breaches)	NA	S	S	S	S
WQ-3: Increase in Salinity in the Napa River Mitigation: Measures WQ-2 (Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring) and WQ-5 (see above)	NA	S	S	S	S
WQ-4: Increase in Conventional and Toxic Constituents Mitigation: Measure WQ-2 (see above)	NA	S	S	S	S

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Table S-2. Continued

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option				
	No-Project	HRO 1	HRO 2	HRO 3	HRO 4
Water Quality (continued)					
WQ-5: Discharges of Priority Toxic Constituents in the Napa River and Local Sloughs Mitigation: Measure WQ-2 (see above)	NA	S	S	S	S
WQ-6: Increase in Contribution of Conventional and Toxic Constituents from Recycled Water Mitigation: Measure WQ-3 (Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements)	NA	S	S	S	S
WQ-7: Water Quality Changes in the Salt Ponds Mitigation: Measure WQ-4 (Monitor Pond Water Quality and Use Adaptive Management)	NA	S	S	S	S
Biological Resources—Vegetation					
V-1: Loss of Common and Sensitive Vegetation Communities and Special-Status Plants as a Result of Levee Failure and Emergency Repairs	LTS	NA	NA	NA	NA
V-2: Temporary Alteration of Common Vegetation and Sensitive Communities	NA	LTS	LTS	LTS	LTS
V-3: Removal of Soft Bird's-Beak Mitigation: Measure V-1 (Avoid Ground Disturbance in Populations of Soft Bird's-Beak)	NA	S	S	S	S
V-4: Removal of Other Special-Status Species	NA	LTS	LTS	LTS	LTS
V-5: Long-Term Enhancement of Common Vegetation and Sensitive Communities	NA	***B***	***B***	***B***	***B***
V-6: Short-Term Impacts on Common Vegetation and Sensitive Communities	NA	LTS	LTS	LTS	LTS
V-7: Invasion of Nonnative Species Mitigation: Measure V-3 (Monitor and Manage Invasive Exotic Plant Species)	NA	S	S	S	S
Biological Resources—Wildlife					
W-1: Long-Term Decline in Habitat Value and Function	S*	NA	NA	NA	NA
W-2: Temporary Disturbance of Wildlife	S*	NA	NA	NA	NA
W-3: Construction-Related Disturbance and Mortality of Special-Status Species Mitigation: Measure W-1 (Avoid Construction Activities near Nesting Habitats during Breeding Season)	NA	S	S	S	S

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Table S-2. Continued

Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option: No-Project	HRO 1	HRO 2	HRO 3	HRO 4
Biological Resources—Wildlife (continued)					
W-4: Construction-Related Disturbance and Mortality of Salt Marsh Harvest Mouse and Suisun Ornate Shrew Mitigation: Measures W-2 (Avoid Construction Activities near Occupied Suisun Ornate Shrew Habitat or Remove Shrews) and W-3 (Avoid Construction Activities near Occupied Salt Marsh Harvest Mouse Habitat)	NA	S	S	S	S
W-5: Exposure of Wildlife to Contaminants during Construction Mitigation: Measure WQ-1 (see "Water Quality" above)	NA	S	S	S	S
W-7: Increase in Mudflat Foraging Habitat	NA	***B***	***B***	***B***	***B***
W-8: Long-Term Increase in Subtidal Habitat	NA	***B***	***B***	***B***	***B***
W-9: Increase in Lower Marsh and Middle Marsh Habitats	NA	***B***	***B***	***B***	***B***
W-10: Lowering of Levees to Create Marsh Habitat	NA	***B***	***B***	***B***	***B***
W-11: Exposure of Wildlife to Contaminants in Sediments and Waters from San Pablo Bay and the Napa River	NA	LTS	LTS	LTS	LTS
W-12: Loss of Open-Water Habitat	NA	LTS	LTS	LTS	LTS
Biological Resources—Aquatic Resources					
A-1: Reduced Water Quality as a Result of Uncontrolled Breaches of Levees	S*	NA	NA	NA	NA
A-2: Reduced Water Quality during Construction Activities	LTS	NA	NA	NA	NA
A-3: Disturbance of Substrate and Associated Benthic Organisms during Repair of Levee Breaches	LTS	NA	NA	NA	NA
A-4: Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs	S*	NA	NA	NA	NA
A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds	S*	NA	NA	NA	NA
A-10: Substantial Increase in Habitat Area and Types	NA	***B***	***B***	***B***	***B***
A-11: Short-Term Construction-Related Impacts Mitigation: Measure WQ-1 (see "Water Quality" above)	NA	S	S	S	S
A-12: Stranding of Fish in Restored Tidal Habitat	NA	LTS	LTS	LTS	LTS

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Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option				
	No-Project	**HRO 1**	**HRO 2**	**HRO 3**	**HRO 4**
Geology and Soils					
Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking	S*	LTS	LTS	LTS	LTS
Geo-2: Levee Failure as a Result of Erosion	S*	NA	NA	NA	NA
Geo-3: Levee Failure or Structural Damage as a Result of a Rupture of a Known Earthquake Fault	NA	LTS	LTS	LTS	LTS
Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils	NA	LTS	LTS	LTS	LTS
Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils	NA	LTS	LTS	LTS	LTS
Geo-6: Flooding of the Project Area as a Result of Tsunamis	NA	LTS	LTS	LTS	LTS
Geo-7: Potential Erosion as a Result of Increased Tidal Prism Mitigation: Measures H-1 (Repair Unintended Levee Breaches) and H-3 and H-4 (see "Hydrology" above)	NA	S	S	S	S
Geo-8: Potential Erosion as a Result of Excess Pond Water Height Mitigation: Measure Geo-1 (Maintain Water Level 2 Feet below Levee Crest)	NA	S	S	S	S
Hazards and Hazardous Materials					
Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities Mitigation: Measure Haz-1 (Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation)	LTS	S	S	S	S
Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees Mitigation: Measure Haz-2 (Employ Explosives Experts when Breaching Levees)	NA	S	S	S	S
Transportation and Circulation					
T-1: Temporary Increase in Traffic Volumes as a Result of Emergency Repairs	LTS	NA	NA	NA	NA
T-2: Temporary Increase in Traffic Volumes as a Result of Project Construction	NA	LTS	LTS	LTS	LTS
T-3: Increase in Construction-Related Traffic Hazards	NA	LTS	LTS	LTS	LTS
T-4: Increase in Watercraft Traffic in the Napa River	NA	LTS	LTS	LTS	LTS

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Resources, Impacts, and Mitigation Measures*	Impact Level by Alternative/Option: No-Project	HRO 1	HRO 2	HRO 3	HRO 4
Air Quality					
AQ-1: Increase in Fugitive Dust Emissions Resulting from Increased Desiccation of the Ponds	LTS	NA	NA	NA	NA
AQ-2: Increase in Ambient Pollutant Levels	NA	LTS	LTS	LTS	LTS
AQ-3: Potential Releases of Irritant Dust as a Result of Construction Activities Mitigation: Measure AQ-1 (Minimize Dust Generation in and Implement Dust Control Measures for Work Areas with Salt Crusts), Haz-4 (Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8), and Haz-5 (Prepare and Implement a Safety Plan)	NA	S	S	S	S
Noise					
N-1: Temporary Increase in Ambient Noise Levels as a Result of Emergency Repairs	~~SU~~*	NA	NA	NA	NA
N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction	NA	LTS	LTS	LTS	LTS
N-3: Temporary Increase in Noise Levels as a Result of Blasting Activities	NA	LTS	LTS	LTS	LTS
Land Use and Planning					
LU-1: Compatibility with Land Use Goals and Objectives	NA	LTS	LTS	LTS	LTS
LU-2: Consistency with Existing or Planned Land Uses	NA	LTS	LTS	LTS	LTS
Public Services and Utilities					
PS-1: Conflict with Existing Utilities	LTS	NA	NA	NA	NA
PS-2: Increased Risk of Instability of Power Towers Mitigation: Measure PS-1 (Ensure the Stability of the Power Towers)	NA	S	S	S	S
Recreation, Public Access, Visual Resources, and Public Health					
R-1: Enhanced Recreational Opportunities	NA	***B***	***B***	***B***	***B***
R-2: Consistency with Existing or Proposed Public Access Plans	NA	LTS	LTS	LTS	LTS
R-3: Accelerated Physical Deterioration of a Recreational Facility or Adverse Effects from Facility Expansion	NA	LTS	LTS	LTS	LTS
R-4: Temporary Effect of Construction on Public Access	NA	LTS	LTS	LTS	LTS

Key: HRO = Habitat Restoration Option; NA = Not Applicable.
Significance determinations: B = Beneficial, NI = No Impact, LTS = Less than Significant, S = Significant, SU = Significant and Unavoidable. (Beneficial impacts are shown in ***bold italic***.)

* All significant impacts are reduced to a less-than-significant level with mitigation unless the impact is listed as Significant and Unavoidable (SU) or is listed under the No-Project Alternative (because this alternative would result in no project being implemented, no mitigation is proposed if this occurs).

Table S-2. Continued

Resources, Impacts, and Mitigation Measures*		Impact Level by Alternative/Option				
		No-Project	HRO 1	HRO 2	HRO 3	HRO 4
Recreation, Public Access, Visual Resources, and Public Health (continued)						
R-6:	Increased Mosquito Production Mitigation: Measure R-1 (Coordinate Project Activities with the Napa County Mosquito Abatement District)	NA	S	S	S	S
R-8:	***Enhancement of Existing Visual Character***	NA	***B***	***B***	***B***	***B***
Cultural Resources						
C-1:	Potential to Materially Impair Significant Cultural Resources	NA	LTS	LTS	LTS	LTS
C-2:	Potential for Ground-Disturbing Activities to Damage Previously Unidentified Buried Cultural Resources Sites Mitigation: Measure C-1 (Stop Work If Cultural Resources Are Discovered during Ground-Disturbing Activities)	NA	S	S	S	S
C-3:	Potential to Damage Previously Unidentified Human Remains Mitigation: Measure C-2 (Comply with State Laws Pertaining to the Discovery of Human Remains)	NA	S	S	S	S
Cumulative Impacts						
Cu-1:	Cumulative Hydrologic Changes in the Lower Napa River Mitigation: Measure Cu-1 (Implement Monitoring and Adaptive Management Program)	NA	S	S	S	S
Cu-2:	Cumulative Adverse Change in Water Quality Mitigation: Measures Cu-1 (see above) and WQ-2 (see "Water Quality" above)	NA	S	S	S	S
Cu-3:	***Cumulative Change in Sensitive Plant Communities***	NA	***B***	***B***	***B***	***B***
Cu-4:	Increase in Nonnative Smooth Cord Grass Mitigation: Measure V-3 (Monitor and Manage Invasive Exotic Plant Species)	NA	S	S	S	S
Cu-6:	***Long-Term Increase in Lower and Middle Marsh Habitat Suitable for Special-Status Species***	NA	***B***	***B***	***B***	***B***
Cu-7:	Loss of Open-Water Habitat for Migratory Shorebirds and Waterfowl	NA	LTS	LTS	LTS	LTS
Cu-8:	Exposure of wildlife to contaminants in sediments and water from San Pablo Bay and the Napa River	NA	S	S	S	S
Cu-10:	***Increase in Subtidal Habitat***	NA	***B***	***B***	***B***	***B***

Key: HRO = Habitat Restoration Option; NA = Not Applicable.
Significance determinations: B = Beneficial, NI = No Impact, LTS = Less than Significant, S = Significant, SU = Significant and Unavoidable. (Beneficial impacts are shown in ***bold italic***.)

* All significant impacts are reduced to a less-than-significant level with mitigation unless the impact is listed as Significant and Unavoidable (SU) or is listed under the No-Project Alternative (because this alternative would result in no project being implemented, no mitigation is proposed if this occurs).

Table S-3. Summary of Significant Environmental Effects and Mitigation Measures

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Hydrology				
H-2: Modification of Surface Drainage Patterns	S	Measure H-2 (Avoid Drainage Pattern Alteration in Plans for Future Pipeline Alignments)	LTS	1, 2, 3, 4, 5, 6, 7
H-3: Increased Risk of Property Damage, Injury, or Death as a Result of Flooding	S	Measure H-1 (Repair Unintended Levee Breaches)	LTS	2, 3, 4, 5, 6, 8
H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels	S	Measure H-3 (Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge)	LTS	1, 2, 3, 4, 5, 6, 7, 8
H-8: Potential Increase in Flood Risk on Adjacent Properties as a Result of Wave Erosion	S	Measure H-4 (Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Water Quality				
WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water	S	None required for No-Project Alternative	NA	No-Project
WQ-2: Short-Term Construction-Related Water Quality Impacts	S	Measure WQ-1 (Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-5 (Prepare Levees and Time Breaches)	LTS ~~S~~	1, 2, 3, 4, 5, 6, 7, 8 ~~3, 5~~
		Measure WQ-6 (Prepare and Implement Storm Water Pollution Prevention Plans)	LTS	1, 2, 3, 4, 5, 6, 7
WQ-3: Increase in Salinity in the Napa River	S	Measure WQ-2 (Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-5 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
WQ-4: Increase in Conventional and Toxic Constituents	S	Measure WQ-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Water Quality (continued)				
WQ-5: Discharges of Priority Toxic Constituents in the Napa River and Local Sloughs	S	Measure WQ-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
WQ-6: Increase in Contribution of Conventional and Toxic Constituents from Recycled Water	S	Measure WQ-3 (Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements)	LTS	1, 2, 3, 4, 5, 6, 7~~, 8~~
WQ-7: Water Quality Changes in the Salt Ponds	S	Measure WQ-4 (Monitor Pond Water Quality and Use Adaptive Management)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Vegetation				
V-2: Temporary Alteration of Common Vegetation and Sensitive Communities	S	Measure V-2 (Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures)	LTS	1, 2, 3, 4, 5, 6, 7
V-3: Removal of Soft Bird's-Beak	S	Measure V-1 (Avoid Ground Disturbance in Populations of Soft Bird's-Beak)	LTS	1, 2, 3, 4, 5, 6, 7, 8
V-7: Invasion of Nonnative Species	S	Measure V-3 (Monitor and Manage Invasive Exotic Plant Species)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Wildlife				
W-1: Long-Term Decline in Habitat Value and Function	S	None required for No-Project Alternative	NA	No-Project
W-2: Temporary Disturbance of Wildlife	S	None required for No-Project Alternative	NA	No-Project
W-3: Construction-Related Disturbance and Mortality of Special-Status Species	S	Measure W-1 (Avoid Construction Activities near Nesting Habitats during Breeding Season)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-4 (Complete Focused Surveys for Special-Status Wildlife Species before Construction)	LTS	1, 2, 3, 4, 5, 6, 7<u>, 8</u>
		Measure W-5 (Educate Construction Crews regarding Special-Status Wildlife Species)	LTS	1, 2, 3, 4, 5, 6, 7<u>, 8</u>
		Measure W-6 (Use Trenchless Construction Techniques for Special-Status Wildlife Species Protection)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure W-7 (Restore Habitat Modified by Construction)	LTS	1, 2, 3, 4, 5, 6, 7

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Biological Resources—Wildlife (continued)				
W-4: Construction-Related Disturbance and Mortality of Salt Marsh Harvest Mouse and Suisun Ornate Shrew	S	Measure W-2 (Avoid Construction Activities near Occupied Suisun Ornate Shrew Habitat or Remove Shrews)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-3 (Remove Salt Marsh Harvest Mice from the Immediate Vicinity of Operating Equipment)	LTS	1, 2, 3, 4, 5, 6, 7, 8
W-5: Exposure of Wildlife to Contaminants during Construction	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
W-6: Interference with the Movement of Wildlife	S	Measure W-8 (Complete Wildlife Surveys before Construction)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Aquatic Resources				
A-1: Reduced Water Quality as a Result of Uncontrolled Breaches of Levees	S	None required for No-Project Alternative	S	No-Project
A-4: Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs	S	None required for No-Project Alternative	S	No-Project
A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds	S	None required for No-Project Alternative	S	No-Project
		Measure A-1 (Minimize Entrainment of Sensitive Species)	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	2, 3, 4, 5, 6, 8
		Measure A-2 (Install Cofferdams to Minimize In-Water Construction)	LTS	1, 7
		Measure A-4 (Use Trenchless Technology during Construction to Protect Aquatic Species)	LTS	1, 2, 3, 4, 5, 6, 7
A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality	S	Measure WQ-2 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 8
		Measure WQ-3 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 8
		Measure WQ-4 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 8
		Measure A-3 (Assess and Maintain Salinity Levels Protective of Aquatic Resources)	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-9: Substantial Interference with the Movement or Migration of Fish Species	S	Measure A-4 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-11: Short-Term Construction-Related Impacts	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Geology and Soils				
Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking	S	None required for No-Project Alternative	S	No-Project
Geo-2: Levee Failure as a Result of Erosion	S	None required for No-Project Alternative	S	No-Project
Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils	S	Measure Geo-3 (Remove Unstable or Expansive Soils and Backfill with Engineered Fill)	LTS	1, 2, 3, 4, 5, 6, 7
Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils	S	Measure Geo-3 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7
Geo-7: Potential Erosion as a Result of Increased Tidal Prism	S	Measures H-1, H-3, and H-4 *(see "Hydrology" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Geo-8: Potential Erosion as a Result of Excess Pond Water Height	S	Measure Geo-2 (Maintain Water Level 2 Feet below Levee Crest)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Hazards and Hazardous Materials				
Haz-1: Potential Release of Bittern or Highly Saline Brines into the Environment as a Result of Levee Breaching	S	None required for No-Project Alternative	S	No-Project
Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities	S	Measure Haz-1 (Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees	S	Measure Haz-2 (Employ Explosives Experts when Breaching Levees)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-5: Potential Releases of Irritant Dust as a Result of Construction Activities	S	Measure Haz-3 (Develop and Implement a Health and Safety Plan)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-4 (Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-9: Exposures Resulting from Exceeding Human Health Criteria	S	Measure Haz-5 (Prepare and Implement a Safety Plan)	LTS	1, 2, 3, 4, 5, 6, 7
Transportation and Circulation				
T-3: Increase in Construction-Related Traffic Hazards	S	Measure T-1 (Implement Safety Plan for Pipeline Construction along Rail Line)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure T-2 (Implement Safety Plan for Construction along Public Roads)	LTS	1, 2, 3, 4, 5, 6, 7

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Air Quality				
AQ-3: Potential Releases of Irritant Dust as a Result of Construction Activities	S	Measure AQ-1 (Minimize Dust Generation and Implement Dust Control Measures for Work Areas with Salt Crusts)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-4 *(see "Hazards and Hazardous Materials" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-5 *(see "Hazards and Hazardous Materials" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Noise				
N-1: Temporary Increase in Ambient Noise Levels as a Result of Emergency Repairs	SU	None required for No-Project Alternative	SU	No-Project
N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction	SU	Measure N-1 (Decrease Noise Levels with Use of Noise Reduction Devices)	SU	1, 2, 3, 4, 5, 6, 7
Land Use and Planning				
LU-1: Compatibility with Land Use Goals and Objectives	S	Measure N-1 *(see "Noise" above)*	LTS	1, 2, 3, 4, 5, 6, 7
Public Services and Utilities				
PS-2: Increased Risk of Instability of Power Towers	S	Measure PS-1 (Ensure the Stability of the Power Towers)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Recreation, Public Access, Visual Resources, and Public Health				
R-6: Increased Mosquito Production	S	Measure R-1 (Coordinate Project Activities with the Napa County Mosquito Abatement District)	LTS	1, 2, 3, 4, 5, 6, 7, 8
R-7: Short-Term Conflicts with Existing or Planned Recreational Uses, and Recreation Plans and Policies	S	Measure R-2 (Prepare a Public Access Plan)	LTS	1, 2, 3, 4, 5, 6, 7
Cultural Resources				
C-2: Potential for Ground-Disturbing Activities to Damage Previously Unidentified Buried Cultural Resources Sites	S	Measure C-1 (Stop Work If Cultural Resources Are Discovered during Ground-Disturbing Activities)	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Cultural Resources (continued)				
C-3: Potential to Damage Previously Unidentified Human Remains	S	Measure C-2 (Comply with State Laws Pertaining to the Discovery of Human Remains)	LTS	1, 2, 3, 4, 5, 6, 7, 8
C-4: Changes in the Significance of a Historic and/or Archaeological Resource	S	Measure C-3 (Conduct Archaeological Monitoring of Construction Activities in the Vicinity of CA-NAP-224, C-164, and CA-NAP-230)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure C-4 (Conduct Records Search and Visual Survey)	LTS	1, 2, 3, 4, 5, 6, 7
C-5: Disturbance of Human Remains	S	Measure C-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7
Cumulative Impacts				
Cu-1: Cumulative Hydrologic Changes in the Lower Napa River	S	Measure Cu-1 (Implement Monitoring and Adaptive Management Program)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-2: Cumulative Adverse Change in Water Quality	S	Measure WQ-2 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Cu-1 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-4: Increase in Nonnative Smooth Cord Grass	S	Measure V-3 *(see "Biological Resources—Vegetation" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-5: Cumulative Reduction in Sensitive Vegetation Species and their Habitats	S	Measure Cu-2 (Conduct Biological Surveys for Sensitive Biological Resources)	LTS	1, 2, 3, 4, 5, 6, 7
Cu-7: Loss of Open-Water Habitat for Migratory Shorebirds and Waterfowl	LTS	None required	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-8: Exposure of Wildlife to Contaminants in Sediments and Waters from San Pablo Bay and the Napa River	S	Measure Cu-3 (Contribute to Regional Research Efforts on the Exposure of Wildlife to Contaminants)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-9: Cumulative Reduction in Sensitive Wildlife Species and their Habitats	S	Measure Cu-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table S-4. Summary of Beneficial Impacts

Resource/Effect	Applicable Alternatives
Hydrology	
H-1: Reduced Risk of Property Damage, Injury, or Death as a Result of Flooding	1, 2, 3, 4, 5, 6, 7, 8
H-5: Increased Flood Conveyance Capacity	1, 2, 3, 4, 5, 6, 7, 8
Water Quality	
W-8: Long-Term Changes to Water Quality in Local Rivers and Salt Ponds from Project Operations	1, 2, 3, 4, 5, 6, 7
Biological Resources—Vegetation	
V-5: Long-Term Enhancement of Common Vegetation and Sensitive Communities	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Wildlife	
W-7: Increase in Mudflat Foraging Habitat	1, 2, 3, 4, 5, 6, 7, 8
W-8: Long-Term Increase in Subtidal Habitat	1, 2, 3, 4, 5, 6, 7, 8
W-9: Increase in Lower Marsh and Middle Marsh Habitats	1, 2, 3, 4, 5, 6, 7, 8
W-10: Lowering of Levees to Create Marsh Habitat	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Aquatic Resources	
A-10: Substantial Increase in Habitat Area and Types	1, 2, 3, 4, 5, 6, 7, 8
Geology and Soils; Hazards and Hazardous Materials; Transportation and Circulation; Air Quality; Noise; Land Use and Planning; Public Services and Utilities	
No beneficial impacts for these resource areas.	
Recreation, Public Access, Visual Resources, and Public Health	
R-1: Enhanced Recreational Opportunities	1, 2, 3, 4, 5, 6, 7, 8
Cultural Resources	
No beneficial impacts for this resource area.	
Cumulative Impacts	
Cu-3: Cumulative Change in Sensitive Plant Communities	1, 2, 3, 4, 5, 6, 7, 8
Cu-6: Long-Term Increase in Lower and Middle Marsh Habitat Suitable for Special-Status Species	1, 2, 3, 4, 5, 6, 7, 8
Cu-9: Increase in Subtidal Habitat	1, 2, 3, 4, 5, 6, 7, 8

Alternative 6 is considered the environmentally superior alternative because it would result in relatively quick salinity reduction of the lower ponds (several weeks for Pond 3 and several months for Pond 4/5), reducing the potential for adverse effects to aquatic resources. Construction-related ground disturbance associated with this alternative is equivalent to Alternatives 1, 2, 5, 7, and 8, and less than Alternative 3. While there would be more construction-related ground disturbance than under Alternative 4, Alternative 4 does not result in the optimal mix of restored habitats. The short period of time for salinity reduction helps the habitat restoration process proceed sooner under Alternative 6 than all others except Alternative 5 (which requires the use of fill). Alternative 6 provides a mixture of pond and tidal marsh habitats that meets the project objectives and is phased in in a way that would minimize current and future adverse effects.

The No-Project Alternative is not considered the environmentally superior alternative because of the continued deterioration of the site and potential for long-term adverse water quality effects.

S.9.2 Irreversible or Irretrievable Commitments of Resources

The project would result in the irretrievable commitment of fossil fuels and other energy sources to build, operate, and maintain the wetlands. The restoration of the site to wetlands, however, is not considered an irreversible or irretrievable commitment because the landscape could be converted to other land uses in the future.

S.9.3 Environmental Commitments

The Corps and DFG will adhere to several basic environmental commitments as part of the project, including preconstruction surveys for wildlife and plants, and implementing the Bay Area Air Quality Management District's (BAAQMD's) soil management best management practices (BMPs) to minimize airborne dust. BMPs may include the following list:

- All construction areas, unpaved access roads, and staging areas will be watered as needed during dry soil conditions, or soil stabilizers will be applied.
- All trucks hauling soil or other loose material will be covered or have at least 2 feet of freeboard. Wherever possible, construction vehicles will use paved roads to access the construction site.
- Vehicle speeds will be limited to 15 mph on unpaved roads and construction areas, or as required to control dust.
- Streets will be cleaned daily to remove soil material carried onto adjacent public streets.

- Soil stabilizers will be applied daily to inactive construction areas as needed.
- Exposed stockpiles of soil and other excavated materials will be enclosed, covered, watered twice daily, or applied with soil binders as needed.
- Vegetation will be replanted in disturbed areas along the pipeline alignment as quickly as possible following the completion of construction.

In addition, under the habitat restoration options, pond management in the long term would be based on a DFG management plan, which weould be developed under DFG and CEQA guidelines. Finally, to ensure the maintenance of water quality and compliance with water quality standards—specifically, the Clean Water Act Section 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plan), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards)—DFG will adhere to the permit issued by the San Francisco Regional Water Quality Control Board (RWQCB) on Waste Discharge Requirements and a Water Quality Certification that may include:

- discharge prohibitions,
- effluent limitations,
- receiving water limitations,
- general provisions,
- soil excavation and placement provisions,
- design provisions, and
- monitoring and reporting provisions.

S.9.4 Growth Inducement

Section 15162.2(d) of the State CEQA Guidelines requires that an EIR address the potential growth-inducing impacts of a proposed project. Specifically, the EIR shall "discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing either directly or indirectly, in the surrounding environment." Similarly, NEPA requires the analysis of indirect effects, including growth inducing effects (40 C.F.R. 1508.8[b]).

The salinity reduction and habitat restoration components of the project would not contribute to regional urbanization as no urban infrastructure or facilities are proposed as part of the project; therefore, they would not result in any growth-inducing effects. However, implementation of the Water Delivery Option could have a growth-inducing impact relative to the potential future use of recycled water for agricultural irrigation. The growth of agricultural activity in the north bay region is currently constrained by the availability of water suitable for irrigation. The provision of recycled water suitable for agricultural irrigation

could foster economic growth in the north bay region, especially relative to vineyard operations in Napa and Sonoma Counties.

S.9.5 Unresolved Issues

Many of the previously unresolved issues have been answered with subsequent modeling, analysis, and field observation over the past year. For example, recent studies indicate:

1. salinity reduction through breaches (e.g., Pond 3) is effective and can occur in a way that does not have adverse short- or long-term effects;

2. salinity in the bittern pond, Pond 7, can be reduced in a substantially shorter period of time than previously estimated (8 to 10 years); and

3. metals concentrations in the high salinity ponds are substantially lower than previously estimated.

Several issues remain unresolved as can be expected from restoration projects~~part of the project~~, including exact impacts on hydrology, water quality, and biological resources. ~~As the final hydrologic modeling has not been completed, t~~The magnitude of the hydrologic effects remains uncertain~~unknown~~; there would likely be areas of scour and increased velocities that result in localized erosion. However, ~~specific modeling,~~ design refinement~~,~~ and monitoring would ensure that these effects are minimized. Similarly, the final water quality analysis continues to show that ~~is not complete for salinity reduction with and without the use of recycled water, but predicted~~ discharge concentrations are within a range that DFG can manage to achieve water quality objectives. Furthermore, ongoing monitoring and compliance with the San Francisco Bay RWQCB standards will ensure that these effects are minimized. The recycled water program component remains unresolved as specific WWTPs have not indicated whether they would participate; however, further environmental compliance would be required for the programmatic components analyzed.

The long-term evolution of habitats in the project area would affect biological resources, and some of these effects remain uncertain~~unresolved~~. There remains some uncertainty about the rate of evolution of the habitats, as there are assumptions associated with sediment deposition rates, waterborne sediment resuspension rates, and plant colonization rates. Although the analysis is conservative, portions of the project could take more or less time to evolve. The long-term use of the site by migratory waterfowl and endangered species also remains uncertain~~unresolved~~, but would be monitored and future management decisions would be influenced by this information. Similarly, contaminants and potential bioaccumulation could pose a threat to the long-term ecological health of some wildlife and aquatic resources. These resources would also be monitored over time to determine the most appropriate management decisions for the project area.

S.9.6 Issues of Known Controversy

The public and the resource agencies are largely supportive of this project; however, several areas of known controversy exist, particularly related to water quality and ecosystem effects. Water quality concerns relate to the potential for adverse environmental effects on aquatic resources, including those effects resulting from the potential project discharges. The ecosystem concerns relate to the short-term impacts and long-term evolution and use of the site by various fish and wildlife species (i.e., controversy over whether endangered species habitat [marsh] should take priority over migratory waterfowl habitat [ponds]). Two other potential areas of controversy relate to how quickly the levees are likely to deteriorate, thereby necessitating quick salinity reduction, and the potential interim loss of accreted marsh habitat.

S.10 Permit and Environmental Review and Consultation Requirements

In addition to CEQA and NEPA, the Napa River Salt Marsh Restoration Project will require compliance with other federal, state, regional, and local environmental laws, including

- Section 7 of the federal Endangered Species Act;
- the Magnuson-Stevens Fishery Conservation and Management Act;
- the Fish and Wildlife Coordination Act;
- Sections 404, 401, 402, and 313 of the Clean Water Act;
- the Clean Air Act;
- the Coastal Zone Management Act;
- the National Historic Preservation Act;
- Executive Order 11988—Floodplain Management;
- Executive Order 11990—Protection of Wetlands;
- Executive Order 12898—Environmental Justice;
- the Migratory Bird Treaty Act;
- the McAteer-Petris Act;
- the California Fish and Game Code (Section 1600 Lake or Streambed Alteration Agreement program);
- California Department of Transportation encroachment permit requirements;
- disabilities regulations (Americans with Disabilities Act, Rehabilitation Act, and Architectural Barriers Act); and

- National Pollutant Discharge Elimination System permitting and Section 401 water quality certification processes through the San Francisco Bay RWQCB and State Water Resources Control Board.

S.11 Public Involvement and Scoping

The project sponsors have provided the public and public agencies several opportunities for involvement with the project, which included discussions about key issues for the Draft EIR/EIS. These opportunities occurred at public meetings in 1998 ~~and~~, 2001 and 2003, and a series of agency and restoration planning meetings between 1998 and 200~~2~~3.

The public involvement process was initiated when the Coastal Conservancy issued a notice of preparation for the project on July 17, 1998, and the Corps issued a notice of intent for the project on July 16, 1998 (63 *Federal Register* 136). The first public scoping meeting was held on July 21, 1998, in the Napa County Board of Supervisors offices. The second public workshop was held on October 23, 2001, in the Napa City-County Library Community Meeting Room, Napa, California.

Specific questions raised during scoping included the following:

- How would the project affect existing species and habitat?
- Would fish be entrained in pumps or trapped in the ponds?
- Would viable populations of threatened and endangered species be maintained in the area during construction and implementation?
- Would construction of the project be planned around critical time periods for different species?
- Would the sources of fresh water be turned off when desalination is finished?
- Would the use of fresh water change the salinity balance of the system?
- Would the project sponsors coordinate with the mosquito abatement districts and other agencies, particularly the U.S. Fish and Wildlife Service (USFWS), to make sure this project does not interfere with their objectives?
- Would opening up the ponds too quickly lead to a scouring out of vegetation in the slough channels?
- Would the waters become too deep for high-tide roosting of shorebirds?
- Would wintering diving birds that use Ponds 1, 1A, 2, and 3 be adversely affected by the project?
- Is dilution the most appropriate solution?
- What other alternatives have been studied?
- What are the potential impacts on privately and publicly held adjacent lands?

- Are there public health implications associated with the use of recycled water?
- Would discharged diluted salt pond water affect the Napa River, San Pablo Bay, or sloughs of the Napa River Unit?

These issues are presented and analyzed in ~~this~~ the Draft EIR/EIS for decision-makers to evaluate the project. An initial study was prepared for the project and is included as Appendix A.

A public meeting on the Draft EIR/EIS was held on May 21, 2003 at the Napa City-County Library. No formal comments on the Draft EIR/EIS were provided by the public at the meeting, though the Coastal Conservancy, DFG and Corps staff responded to questions (Volume 2, Appendix A).

The Napa-Sonoma Marsh Restoration Group, a technical working group, held meetings intermittently between 1998 and 200~~2~~1 and monthly to quarterly meetings beginning in August 2001. The initial purpose of these meetings was to coordinate data collection efforts and update key stakeholders on the status of the project. More recent meetings were designed to update stakeholders on the technical analysis of the project, and obtain input and critiques of the technical analysis (e.g., salinity modeling) and habitat restoration and salinity reduction approaches to be evaluated in the EIR and ~~/~~EIS. Members of this group included staff from

- the Coastal Conservancy;
- the Corps;
- DFG;
- the University of California, Davis;
- the U.S. Geological Survey;
- the San Francisco Estuary Institute;
- Save The Bay;
- The Bay Institute;
- the San Francisco Bay RWQCB;
- Ducks Unlimited;
- Cargill, Inc.;
- the National Audubon Society;
- the Napa County Resource Conservation District;
- the Southern Sonoma County Resource Conservation District;
- USFWS;
- the National Marine Fisheries Service;
- the Sonoma, Napa, and Solano County Mosquito Control Districts;

- the San Pablo Bay National Wildlife Refuge;
- San Francisco Bay Joint Venture;
- San Francisco Bay Conservation and Development Commission; and
- Sonoma County Water Agency.

Chapter 1
Introduction

1.1 Project Background

The California State Coastal Conservancy (Coastal Conservancy), U.S. Army Corps of Engineers (Corps), and California Department of Fish and Game (DFG) (project sponsors) are proposing a salinity reduction and habitat restoration project for the 9,460-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area (NSMWA) (Napa River Unit). The parcel was purchased with funds from the Shell Oil Spill Settlement, the State Lands Commission, the Wildlife Conservation Board, and the Coastal Conservancy. The Napa River Unit is located at the northeast edge of San Pablo Bay, adjacent to the Napa River (Figure 1-1).

The Napa River Unit was first diked off from San Pablo Bay during the 1850s for hay production and cattle grazing. Dike construction continued for several years. Much of the land was converted in the 1950s to salt ponds for salt production through the solar evaporation of bay water. In the early 1990s, Cargill Salt Company stopped producing salt in the ponds in the west side of the Napa River and sold the evaporator ponds to the State of California, which assigned ownership and management of the ponds to DFG.

On September 28, 1994, the Committee on Public Works and Transportation of the U.S. House of Representatives adopted a resolution authorizing the *Napa-Sonoma Marsh Restoration Project Phase I and Phase II Feasibility Studies for the Napa River, California* (Docket 2448), and a reconnaissance study to evaluate the federal interest in the project was completed in 1997. A reconnaissance report was issued by the Corps in August 1997 and the project sponsors initiated the feasibility study in July 1998. The feasibility study has involved development and detailed evaluation of salinity reduction and habitat restoration options as well as an evaluation of the existing conditions at the Napa River Unit. The study has included data collection, including a detailed topographic survey of the project area, hydrologic data in the slough and river system, analysis of water quality and sediment conditions within the ponds, and analysis of the sediment budget in the region. Baseline data have allowed development of a detailed hydrodynamic model of the system, which has been used to analyze salinity reduction and habitat restoration options. Hydrologic modeling is integral to the description of the salinity reduction and habitat

restoration options presented in this document and would continue throughout project design.

Restoration of the Napa River Unit has long been a vision for local resource agencies, conservationists, and planners. It is one of the largest tidal restoration projects on the west coast of the United States and one of many restoration projects throughout the San Francisco Bay area. Baywide restoration planning, including historic and existing conditions and future habitat recommendations, was conducted as part of the Baylands Ecosystem Habitat Goals Project (Goals Project 1999) and provides a regional framework for this project.

1.2 Purpose and Need

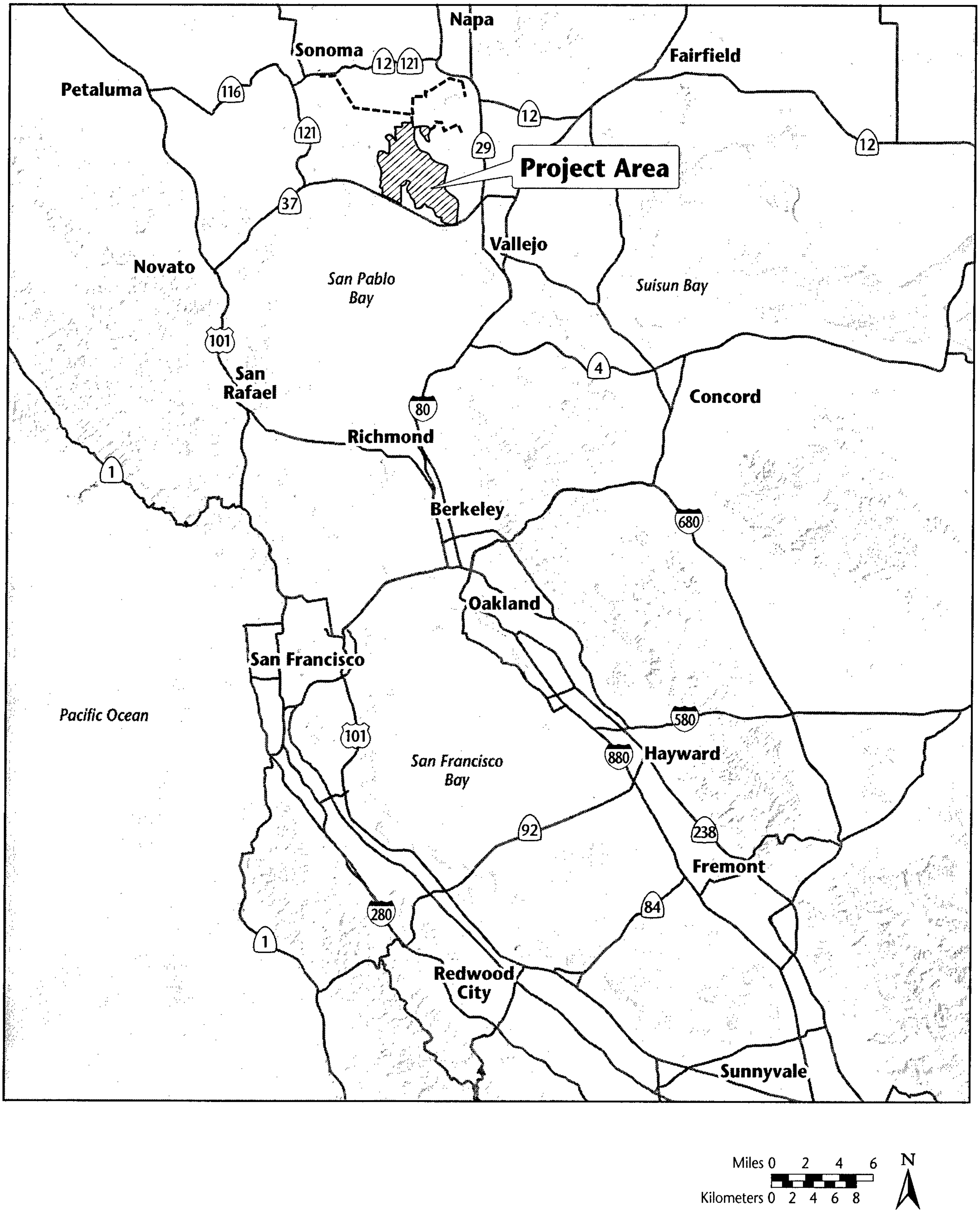
The purpose of the project is to restore a mosaic of habitats, including tidal habitats and managed ponds, to this property and provide for better management of ponds in the Napa River Unit to support populations of fish and wildlife, including endangered species, migratory waterfowl, shorebirds, and anadromous and resident fish. Other important benefits of the project include improved water quality, the potential use of recycled water, and enhanced public open space and wildlife-compatible recreation opportunities. The long-term goal is to produce a natural, self-sustaining habitat that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

The project is needed because of

- historic losses of marsh ecosystems and habitats;
- increasing salinity and declining ecological value in several of the ponds;
- the collapse of the pond system ecology in the absence of salt production or rehabilitation as tidal habitat;
- deterioration of levees, which could lead to levee breaches and uncontrolled high-salinity discharges, resulting in potential fish kills;
- deterioration of water-control structures, which exacerbates the increase in salinity;
- increased restoration costs associated with site deterioration;
- increasing operation and maintenance costs; and
- inadequate water supply, especially during the summer months, resulting in increased salinity, acidic conditions, and drying out of some ponds in summer.

Restoring tidal wetlands, including tidal marsh, within the Napa River Unit would benefit the natural environment by creating

- a large area of contiguous tidal marsh for a diversity of fish and wildlife, including threatened and endangered species (salt marsh harvest mouse, California clapper rail, and black rail);



01396.01 Feas Study

Jones & Stokes

Figure 1-1
Regional Location

- a greater variety of slough channel sizes, a large increase in slough habitat, and greater connections among San Pablo Bay, the Napa River, and the tidal salt marsh, which would benefit estuarine fish, including listed species (Delta smelt, splittail, steelhead trout, and chinook salmon) and other aquatic species, such as the Dungeness crab;
- a natural, self-sustaining system that could adjust to naturally occurring changes in physical processes, with minimum ongoing intervention;
- large tracts of tidal marsh that extend up the Napa River that allow fish and wildlife species to adjust to changes in salinity that occur seasonally and over longer periods because of variations in precipitation;
- increased tidal prism that would scour slough channels, eventually creating large tidal channels, benefiting fish and diving waterfowl;
- improved tidal circulation throughout the system, improving water quality; and
- greatly increased production of organic detritus by tidal marshes, increasing the ecological productivity of San Pablo Bay.

Diking or filling has destroyed approximately 85 – 90% of the original tidal wetlands of the San Francisco Bay region. The loss of tidal wetlands has greatly reduced the amount of habitat available to many species of fish and wildlife. Several animal and plant species native to California, including the salt marsh harvest mouse (*Reithrodontomys raviventris*) and the California clapper rail (*Rallus longirostris obsoletus*), have been federally and state listed as endangered as a result of the severe reduction of wetland habitats.

Salinity is increasing and ecological values are declining in several of the ponds in the Napa River Unit. DFG's ability to maintain the levee system and to control water levels, salinity, and water quality in the ponds is limited by funding and infrastructure constraints. The primary limitations to DFG's successful management are the high operating cost to run poorly performing water intake pumps and low hydroconnectivity between ponds. The current pumps do not supply enough water to prevent a salinity concentration increase, especially during seasonal periods of low precipitation and high water evaporation. Upgraded water intake pumps combined with levee reconstruction would result in improved hydroconnectivity and would enable DFG to improve migratory waterfowl management activities.

Several of the salt pond levees are deteriorating. The ponds are considered a potential threat to the ecology of the north bay region because of the presence of high concentrations of residual salts. It has been estimated that there are currently 2–4 million tons of salt in the ponds. During the commercial production of salt, the solar evaporation system moved bay water through the ponds in sequence as the salts became concentrated. As a result, ponds further along in the system have salinity levels that exceed the salinity level of seawater (ranging from approximately 32 parts per thousand [ppt] to more than 400 ppt).

The salt production process also concentrated soluble salts other than sodium chloride. These additional salts were generally not harvested and accumulated in the pond system in solutions and precipitates known as *bittern*. The uncontrolled release of bittern would be detrimental to the aquatic environment. Additionally, the drying action that occurs within the salt ponds creates undesirable low pH (acidic) values.

Although the water lost through net evaporation can be replaced by water drawn from San Pablo Bay and the lower Napa River, these sources also contain salts that become concentrated in the ponds over time. The annual evaporative water loss from the salt ponds substantially exceeds the amount of water replaced by annual rainfall. Therefore, without the ability to provide both adequate water intake and discharge of pond water through flow-through circulation~~active water management~~, the salt ponds would become increasingly saline and turn into seasonally wet salt flats—or worse, bittern—resulting in the loss of most of their present habitat value for waterbirds and other wildlife species.

The limited capacity and high operating costs of the pumps used to draw water into the ponds are also problematic. Additional infrastructure constraints further limit DFG's ability to move replacement water into the ponds.

1.3 Overview of CEQA and NEPA Compliance

The California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 *et seq.*) and the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321; 40 Code of Federal Regulations [CFR] 1500.1) are the state and federal laws that govern the disclosure and analysis of the environmental effects of agency actions. These regulations are described briefly below.

1.3.1 California Environmental Quality Act

CEQA is regarded as the foundation of environmental law and policy in California. CEQA's primary objectives are to

- disclose to decision makers and the public the significant environmental effects of proposed activities,
- identify ways to avoid or reduce environmental damage,
- prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures,
- disclose to the public reasons for agency approval of projects with significant environmental effects,
- foster interagency coordination in the review of projects, and
- enhance public participation in the planning process.

CEQA applies to all discretionary activities proposed to be carried out or approved by California public agencies, including state, regional, county, and local agencies, unless an exemption applies. It requires that public agencies comply with both procedural and substantive requirements. Procedural requirements include the preparation of the appropriate public notices (including notices of preparation), scoping documents, alternatives, environmental documents (including mitigation measures, mitigation monitoring plans, responses to comments, findings, and statements of overriding considerations); completion of agency consultation and State Clearinghouse review; and provisions for legal enforcement and citizen access to the courts.

CEQA's substantive provisions require agencies to address environmental impacts disclosed in an appropriate document. When avoiding or minimizing environmental damage is not feasible, CEQA requires agencies to prepare a written statement of overriding considerations when they decide to approve a project that will cause one or more significant effects on the environment that can not be mitigated. CEQA establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the State CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law. ~~The Coastal Conservancy~~ DFG is the state lead agency and would use ~~this~~ the environmental impact report~~/environmental impact statement~~ (EIR~~/EIS~~) to comply with the State CEQA Guidelines and to document CEQA compliance. The Coastal Conservancy ~~DFG~~ is a responsible agency and project sponsor and would also use ~~this~~ the EIR~~/EIS~~ to document CEQA compliance.

1.3.2 National Environmental Policy Act

NEPA is the nation's broadest environmental law, applying to all federal agencies and most of the activities they manage, regulate, or fund that affect the environment. It requires federal agencies to disclose and consider the environmental implications of their proposed actions. NEPA establishes environmental policies for the nation, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account.

NEPA requires the preparation of an appropriate document to ensure that federal agencies accomplish the law's purposes. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA. The Corps is the federal lead agency and has prepared this Final EIS~~this EIR/EIS~~ to comply with CEQ's regulations and document NEPA compliance.

~~1.3.3 Combined CEQA and NEPA Document~~

~~Both CEQA and NEPA encourage the preparation of combined environmental planning documents. Therefore, this joint EIR/EIS will serve to fulfill the statutory obligations of both CEQA and NEPA.~~

1.4 Intent and Scope of the ~~EIR/~~EIS

The intent of this ~~EIR/~~EIS is to disclose the environmental impacts associated with this restoration project. The restoration effort would have substantial habitat benefits by restoring portions of the Napa River Unit to a mosaic of wildlife habitats consisting of managed ponds and tidal marsh, but may result in significant hydrologic, water quality, and biological effects.

In accordance with ~~both CEQA and~~ NEPA regulations, this document describes the potential environmental effects caused by construction, operation, and maintenance activities related to restoring the Napa River Unit. It focuses on key issues, including hydrology, water quality, biological resources (vegetation, wildlife, and aquatic resources), and geology and soils. Other resource topics such as air quality, hazardous materials, noise, land use, recreation, and cultural resources are also addressed in this document.

1.5 Public Involvement and Scoping

The project sponsors have provided the public and public agencies with several opportunities for involvement with the project, which included discussions about key issues for the Draft EIR/EIS. These opportunities occurred at public meetings in 1998~~and~~, 2001 and 2003, and a series of agency and restoration planning meetings between 1998 and 2002.

The public involvement process was initiated when the Coastal Conservancy issued a notice of preparation for the project on July 17, 1998, and the Corps issued a notice of intent for the project on July 16, 1998 (63 *Federal Register* [FR] 136). The first public scoping meeting was held on July 21, 1998, in the Napa County Board of Supervisors offices. The second public workshop was held on October 23, 2001, in the Napa City-County Library Community Meeting Room, Napa, California.

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- Is dilution the most appropriate solution?
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These issues are presented and analyzed in ~~this~~ the Draft EIR/EIS for decision makers to evaluate the project. An initial study was prepared for the project and is included as Appendix A.

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County Mosquito Control Districts; San Pablo Bay National Wildlife Refuge; San Francisco Bay Joint Venture; the San Francisco Bay Conservation and Development Commission (BCDC); and Sonoma County Water Agency (SCWA).

1.6 Issues of Known Controversy

The public and the resource agencies are largely supportive of the project; however, several areas of known controversy exist, particularly related to water quality and ecosystem effects. Water quality concerns relate to environmental effects on aquatic resources, including those effects resulting from the potential project discharges. The ecosystem concerns relate to the short-term impacts and the long-term evolution and use of the site by various fish and wildlife species (i.e., controversy over whether endangered species habitat [marsh] should take priority over migratory waterfowl habitat [ponds]). Two other potential areas of controversy relate to how quickly the levees are likely to deteriorate, thereby necessitating quick salinity reduction and the potential interim loss of accreted marsh habitat.

1.7 Report Organization

This ~~EIR/~~EIS is organized into the following chapters:

- Chapter 1. Introduction
- Chapter 2. Site Description, Options, and Alternatives
- Chapter 3. Hydrology
- Chapter 4. Water Quality
- Chapter 5. Biological Resources—Vegetation
- Chapter 6. Biological Resources—Wildlife
- Chapter 7. Biological Resources—Aquatic Resources
- Chapter 8. Geology and Soils
- Chapter 9. Hazards and Hazardous Materials
- Chapter 10. Transportation and Circulation
- Chapter 11. Air Quality
- Chapter 12. Noise
- Chapter 13. Land Use and Planning
- Chapter 14. Public Services and Utilities
- Chapter 15. Recreation, Public Access, Visual Resources, and Public Health
- Chapter 16. Cultural Resources

- Chapter 17. Alternatives
- Chapter 18. Cumulative Impacts and Other Required Analyses
- Chapter 19. List of Recipients
- Chapter 20. List of Preparers
- Chapter 21. References Cited
- Index
- Appendices:
    - Appendix A. Initial Study
    - Appendix B. Section 404(b)(1) Compliance
    - Appendix C. Contaminants Toxic to Wildlife
    - Appendix D. Species that May Occur in the Project Area or Be Affected by the Project
    - Appendix E. Estimated Air Emissions by Option

1.8 Consultation and Other Requirements

In addition to CEQA and NEPA, the Napa River Salt Marsh Restoration Project must fulfill other federal, state, regional, and local environmental requirements as summarized in Table 1-1. As indicated in the table, the proposed project is in compliance with Executive Order 11988—Floodplain Management, and with Executive Order 12898—Environmental Justice because no minority or low-income areas or communities would be involved. In addition, the project adheres to the requirements of the Americans with Disabilities Act, Rehabilitation Act, and Architectural Barriers Act.

Specific requirements for compliance with other environmental regulations are described in the resource chapters cited below.

- Federal Requirements:
    - Endangered Species Act (Chapter 5, "Biological Resources—Vegetation"; Chapter 6, "Biological Resources—Wildlife"; and Chapter 7, "Biological Resources—Aquatic Resources");
    - Magnuson-Stevens Fishery Conservation and Management Act (Chapter 7);
    - Fish and Wildlife Coordination Act (Chapters 5 and 6);
    - Clean Water Act Sections 404, 401, 402, and 313 (Chapter 4, "Water Quality," and Chapters 5 and 6);
    - Clean Air Act (Chapter 11, "Air Quality");
    - Coastal Zone Management Act (Chapter 3, "Hydrology");

  - National Historic Preservation Act (Chapter 16, "Cultural Resources");
  - Executive Order 11990—Protection of Wetlands (Chapters 5 and 6); and
  - Migratory Bird Treaty Act (Chapter 6);
- State Requirements:
  - California Endangered Species Act (Chapters 5, 6, and 7);
  - McAteer-Petris Act (Chapter 3);
  - California Fish and Game Code (Section 1600 Lake or Streambed Alteration Agreement Program) (Chapters 3, 5, 6, and 7); and
  - California Department of Transportation Encroachment Permit (Chapter 10, "Transportation and Circulation").
- Regional and Local Requirements:
  - Bay Conservation and Development Commission Permit and Bay Plan Compliance (Chapter 3); and
  - San Francisco Bay Regional Water Quality Control Board and State Water Resources Control Board Policies and Procedures (Chapter 4).

Table 1-1. Summary of Regulatory Compliance for the Project

Legal Statute	Status of Compliance
NEPA	Ongoing as part of this document
CEQA	Completed during April 2004~~Ongoing as part of this document~~
Federal Endangered Species Act (ESA) and California Endangered Species Act (CESA)	Ongoing as part of this document
Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)	Ongoing as part of this document
Fish and Wildlife Coordination Act (FWCA)	Ongoing; USFWS has participated in advisory groups reviewing or conducting endangered species surveys and conducting a habitat evaluation analysis for the project, and has completed a Fish and Wildlife Coordination Act Report (CAR). USFWS will continue to participate in mitigation and monitoring plan (MMP) monitoring and adaptive management.
Clean Water Act (CWA)	Ongoing; State Water Resources Control Board (SWRCB) will issue water quality certification after the final design and environmental documents are completed.
Clean Air Act (CAA)	Ongoing; conformity analysis is included as part of this document.
Coastal Zone Management Act	Ongoing; consistency~~conformity~~ determination from BCDC needed
National Historic Preservation Act (NHPA)	Ongoing; once Section 106 review process is completed by the Corps, the project would proceed in accordance with conditions stipulated in the agreement with the State Historic Preservation Officer (SHPO) and appropriate agencies.
Executive Order 11988—Floodplain Management	In compliance
Executive Order 11990—Protection of Wetlands	In compliance
Migratory Bird Treaty Act (MBTA)	The Corps and Coastal Conservancy would comply with provisions of the MBTA.
McAteer-Petris Act	Ongoing; BCDC San Francisco Bay permit or conformity determination for minor bay fill is needed.
California Fish and Game Code (Section 1600 Lake or Streambed Alteration Agreement Program)	~~Ongoing; the project complies with Section 1600 by using this document to address expected project effects.~~ DFG has determined that the restoration project area is not subject to Section 1600
California Department of Transportation (Caltrans) Encroachment Permit	Ongoing; an encroachment permit would be required before construction may begin.
Disabilities Regulations—Americans with Disabilities Act (ADA), Rehabilitation Act, and Architectural Barriers Act (ABA)	Ongoing; the project adheres to the construction guidelines of the Uniform Federal Accessibility Standards and complies with regulations proposed for incorporation into the ADA Accessibility Guidelines.

1.9 Other Pertinent Studies and Documents

San Pablo Bay, including the Napa River Unit, has been studied extensively. A complete list of pertinent studies and documents developed through the year 2000 is provided in *Napa River, Salt Marsh Restoration Feasibility Study Biophysical Bibliography* (Tetra Tech 2000). Key pertinent studies and documents for this project include those listed below.

1.9.1 Physical and Modeled Analysis

1.9.1.1 Hydrodynamic and Geomorphologic Analysis

Philip Williams and Associates (PWA) has conducted extensive modeling of the proposed project area as part of the hydrodynamic and geomorphologic analysis. One document recently released entitled *Hydrodynamic Modeling Analysis of Existing Conditions* (Philip Williams and Associates 2002a) was prepared to characterize the baseline or existing hydrodynamic conditions and construct a hydrodynamic model to simulate these conditions. In addition, geomorphic interpretation of the response of slough channels to the tidal restoration of the marsh system was investigated.

The existing physical conditions characterized include parameters such as water surface elevation and salinity and sediment transport, using a combination of one- and two-dimensional computational modeling. One-dimensional (1-D) computational modeling is used to describe the predominantly 1-D flow through the network of slough channels and rivers (the Napa River and Sonoma Creek), and two-dimensional (2-D) computational modeling is used to describe the predominantly 2-D mixing processes in the former salt ponds. This study is closely connected to other recent projects that are described in more detail in Chapter 3, "Hydrology."

PWA also concurrently prepared the *Napa Sonoma Marsh Restoration Feasibility Study Phase 2 Stage 1* report (Philip Williams and Associates 2002b), which describes and evaluates the salinity reduction alternatives, and the *Napa River Salt ~~Sonoma~~ Marsh Restoration Habitat Restoration Preliminary Design ~~Feasibility Study~~ Phase 2 Stage 2 of the Hydrology and Geomorphology Assessment in Support of the Feasibility Report* ~~report~~ (Philip Williams and Associates 2002c), which describes and evaluates the habitat restoration alternatives. PWA and DHI Water and Environment conducted additional 2-dimensional modeling of Pond 4 and the Upper Ponds in May 2003 with follow-up field sampling conducted in the fall of 2003. This modeling was conducted to better assess the near field mixing associated with the breach of Pond 4 and the diffusers on the Upper Ponds. These studies provide the foundation for the hydrodynamic and geomorphologic analysis in the ~~EIR/~~EIS.

1.9.1.2 Water Quality and Sediment Characterization

An extensive water quality and sediment characterization study was prepared for the Napa River Unit by HydroScience Engineers, Inc. This study is described in the report *Water Quality and Sediment Characterization* (HydroScience Engineers 2002). This report details the sampling analysis plan and the quality assurance project plan prepared to ensure consistency and quality control throughout the data collection process. The San Francisco Bay RWQCB approved the sampling approach. The report includes detailed information on the quality of receiving water, pond water, and pond sediment. The water quality analysis focused on general water quality parameters, volatile organic

compounds, semivolatile organic compounds, metals, and organics. In the Coastal Conservancy's and DFG's restoration efforts in the South San Francisco Bay, it became apparent that there were inaccuracies in the laboratory analysis of aqueous metals samples due to elevated levels of salinity. Therefore, a new sampling and metal evaluation procedure was proposed for Pond 4, 7, 7A, and 8 in the project area. The 2003 sampling results by Frontier Geosciences revealed that metals were not a high as previously estimated. Th~~is~~ese stud~~y~~ies and the modeling conducted by PWA provide the foundation for the water quality analysis in the ~~EIR/~~EIS.

1.9.1.3 Baseline Monitoring of Pond 2A Tidal Restoration Project

Pond 2A of the NSMWA was opened to tidal action in 1995. PWA and MEC Analytical Systems, Inc. (MEC Analytical Systems 2000), monitored the physical and biological evolution of the marsh in this pond. Over a 4-year period, data was collected on the levee breaches, sediment chemistry and grain size, sedimentation rates, tidal range and response, water quality, fish usage, avian usage, and plant colonization. These data are helpful in evaluating the effects of future breaches.

1.9.2 Biological Analysis

1.9.2.1 *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds*

The most recent biological study of the project area was conducted by USGS to provide basic information on the habitats, species abundance, and processes within the Napa River Unit. The report, entitled *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds, San Francisco Bay Estuary, 2000 Progress Report* (Takekawa et al. 2000), provides important baseline information on the productivity and habitat values in the existing marsh and salt pond system.

The report was prepared as an interim summary of a 2-year study of the Napa River Unit. The final report has not yet been released; however, the interim report provides useful data for assessing the effects of the project. USGS scientists selected six of the 12 ponds across a range of salinities for intensive studies. The existing site conditions and ponds, including pond numbering, are provided in Chapter 2, "Site Description and Options." These ponds included low salinities, moderate salinities, and high salinities; the recently restored Pond 2A was also evaluated. Salinity ranges for the ponds during the 2000 field season varied from 7.8 to 264 ppt, depending on rainfall. Surveys were conducted for birds, and sampling was conducted for fish, invertebrates, and water quality within each pond bimonthly. (Takekawa et al. 2000.)

1.9.2.2 *Baylands Ecosystem Habitat Goals—A Report of Habitat Recommendations*

This report presents recommendations for the kinds, amounts, and distribution of wetlands and related habitats needed to sustain diverse and healthy communities of fish and wildlife resources in the San Francisco Bay area (Goals Project 1999). The Goals Project began in 1995 and involved more than 100 participants representing local, state, and federal agencies, academia, and the private sector. The process for developing the goals involved the selection of key species and key habitats, assembling and evaluating information, preparing recommendations, and integrating recommendations into the goals.

1.9.2.3 *Baylands Ecosystem Species and Community Profiles—Life Histories and Environmental Requirements of Key Plants, Fish, and Wildlife*

The companion volume to the *Report of Habitat Recommendations* (Goals Project 2000), this report is a reference volume for the 120 species of invertebrates, fish, amphibians, reptiles, mammals, and birds evaluated as part of the Goals Project. It provides a detailed overview of each species' historic and modern distribution, use of habitats, migration, relationship and interaction with other species, conservation and management issues, research needs, and habitat recommendations.

1.9.3 Management Plans and Strategies

1.9.3.1 Comprehensive Conservation and Management Plan

The San Francisco Estuary Project developed a Comprehensive Conservation and Management Plan (CCMP) for San Francisco Bay with input from more than 100 representatives from the public and private sectors, including government, industry, business, and environmental interests, as well as elected officials from all 12 San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) counties.

The CCMP presents a blueprint of 145 specific actions to restore and maintain the chemical, physical, and biological integrity of the bay and Delta. It seeks to achieve high standards of water quality; to maintain an appropriate indigenous population of fish, shellfish, and wildlife; to support recreational activities; and to protect the beneficial uses of the Bay-Delta estuary.

1.9.3.2 Implementation Strategy of the San Francisco Bay Joint Venture

The San Francisco Bay Joint Venture (SFBJV) is a partnership of public agencies, environmental organizations, the business community, local governments, the agricultural community, and landowners working cooperatively to protect, restore, increase, and enhance wetlands and riparian habitat in San Francisco Bay and adjoining watersheds. The SFBJV shares the following objectives:

- secure, restore, and improve wetlands, riparian habitat, and associated uplands by applying incentives and using nonregulatory techniques;
- strengthen and promote new sources of funding for such efforts;
- improve habitat management on public and private lands through cooperative agreements and incentives; and
- support the monitoring and evaluation of habitat restoration projects and research to improve future restoration projects.

The implementation strategy is a blueprint for acquiring, enhancing, and restoring bay habitats, seasonal wetlands, and creeks and lakes. Over the next two decades SFBJV partners plan to protect 63,000 acres, restore 37,000 acres, and enhance another 35,000 acres of bay habitats that include tidal flats, marshes, and lagoons.

Chapter 2

Site Description, Options, and Alternatives

2.1 Introduction

This chapter provides information on the project area, habitat restoration goals and objectives, and development of alternatives for the Napa River Salt Marsh Restoration Project. It also discusses project alternatives and alternatives not considered in this document.

2.2 Site Description

2.2.1 Project Location

The project area was historically the marshland between the Napa River and Sonoma Creek in the north San Pablo Bay region and is now called the Napa River Unit of the California Department of Fish and Game's (DFG's) Napa-Sonoma Marshes Wildlife Area (NSMWA). Figure 2-1 shows the project area and some of the surrounding DFG-managed wildlife areas. The Napa-Sonoma Marsh historically encompassed more than 38,000 acres extending from San Pablo Bay north to the historic limits of the tidal baylands and east to west between the Napa River and Tolay Creek. Of the 38,000 acres, 25,000 acres of the marshlands were in the Napa River watershed. Today, approximately 36% of this acreage remains classified as wetland habitat, while 25% consists of inactive solar salt production ponds, 12% residential areas, and 20% cropland and pasture; the remaining 7% has miscellaneous uses. The salt ponds, cropland, and pasture are diked to prevent tidal and fluvial inundation under normal conditions. A majority of the remaining wetland areas are public lands and are under the management of DFG as part of the NSMWA.

2.2.2 Historical Operation

Cargill Salt Company operated the salt ponds in sequence to concentrate salt by solar and wind evaporation. Tidal flows initiated the salt production process by pushing water into Pond 1 that could then be pumped consecutively to the other ponds (Pond 1A, Pond 2, Pond 2A, Pond 3, etc.), successively increasing the salt

concentration (salinity) in each pond. After reaching Pond 8, the saline concentrate would be pumped to the east side of the Napa River to be further processed in one of the "pickle ponds" and then in one of the "crystallizer ponds." These ponds on the east side of the Napa River have since been purchased by the California DFG. Pond 7 was used as the bittern pond, a repository of concentrated soluble salts other than sodium chloride. In general, Cargill had target salinity ranges for each pond and maintained these salinities unless there were management problems in the system. Cargill added cross levees between Ponds 1 and 1A, 6 and 6A, and 7 and 7A to improve its management of salinities in these ponds. Cargill used materials excavated from borrow ditches to construct interior and exterior levees and as a part of its postconstruction maintenance of all levees. Cargill had a full-time operator and owned dredging equipment, in particular a specially modified shallow draft dredge called the *Mallard*, for the maintenance of the ponds.

2.2.3 Current Operation

Current operations are designed to manage the site for wildlife. However, deteriorating infrastructure, existing high salinity conditions, and limited funding often make this task difficult. The on-site DFG manager strives to use both San Pablo Bay water and Napa River water to reduce/manage salinities to the extent possible and ensure appropriate water levels for wildlife. Generally, Napa River water is moved south and San Pablo Bay water is moved north. Salinity in and elevation of each pond are recorded monthly.

Current operating conditions provide a mix of wildlife habitats including tidal mudflats, deep water, salt ponds, levees, fringing marsh, and marsh sloughs. These habitats are described in detail in Chapter 6, "Biological Resources—Wildlife."

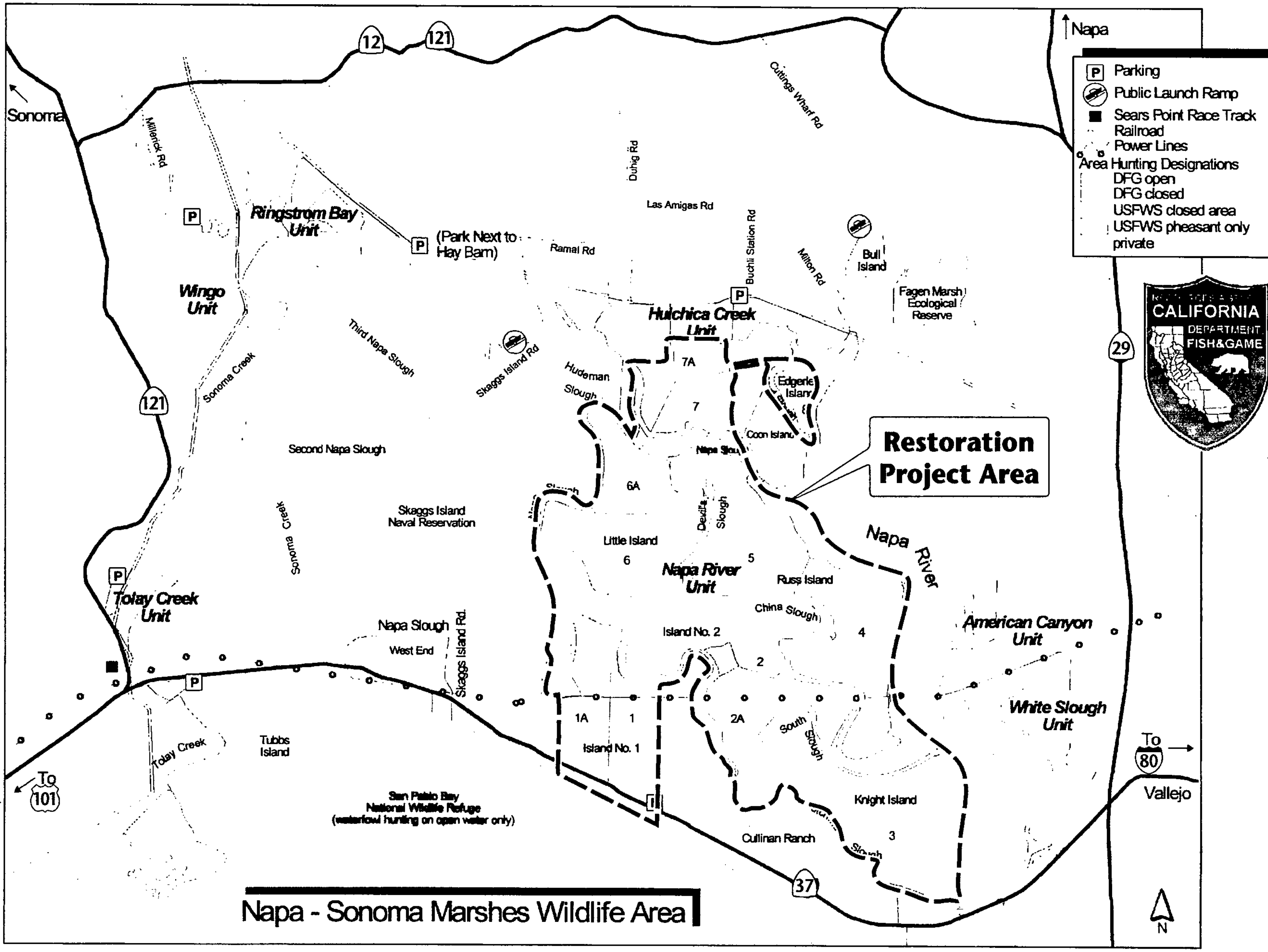
Activities currently underway by DFG as ongoing operation and maintenance include ~~installation of the new water control structure at Pond 8,~~ ongoing maintenance and repair of water control structures, limited levee maintenance, and water level/salinity management for wildlife habitat. The installation of a Pond 8 water control structure was completed in the summer of 2002. The structure is now operational.

2.2.4 Existing Facilities and Conditions

Existing facilities and conditions are depicted in Figure 2-2 and described below.

2.2.4.1 Pond Acreage and Conditions

The 9,460-acre site consists of 7,190 acres of salt ponds and levees and 2,270 acres of fringing marsh and sloughs (Table 2-1).



Source: California Department of Fish and Game

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Jones & Stokes

Figure 2-1
Restoration Project Area and Surrounding Areas Managed by DFG

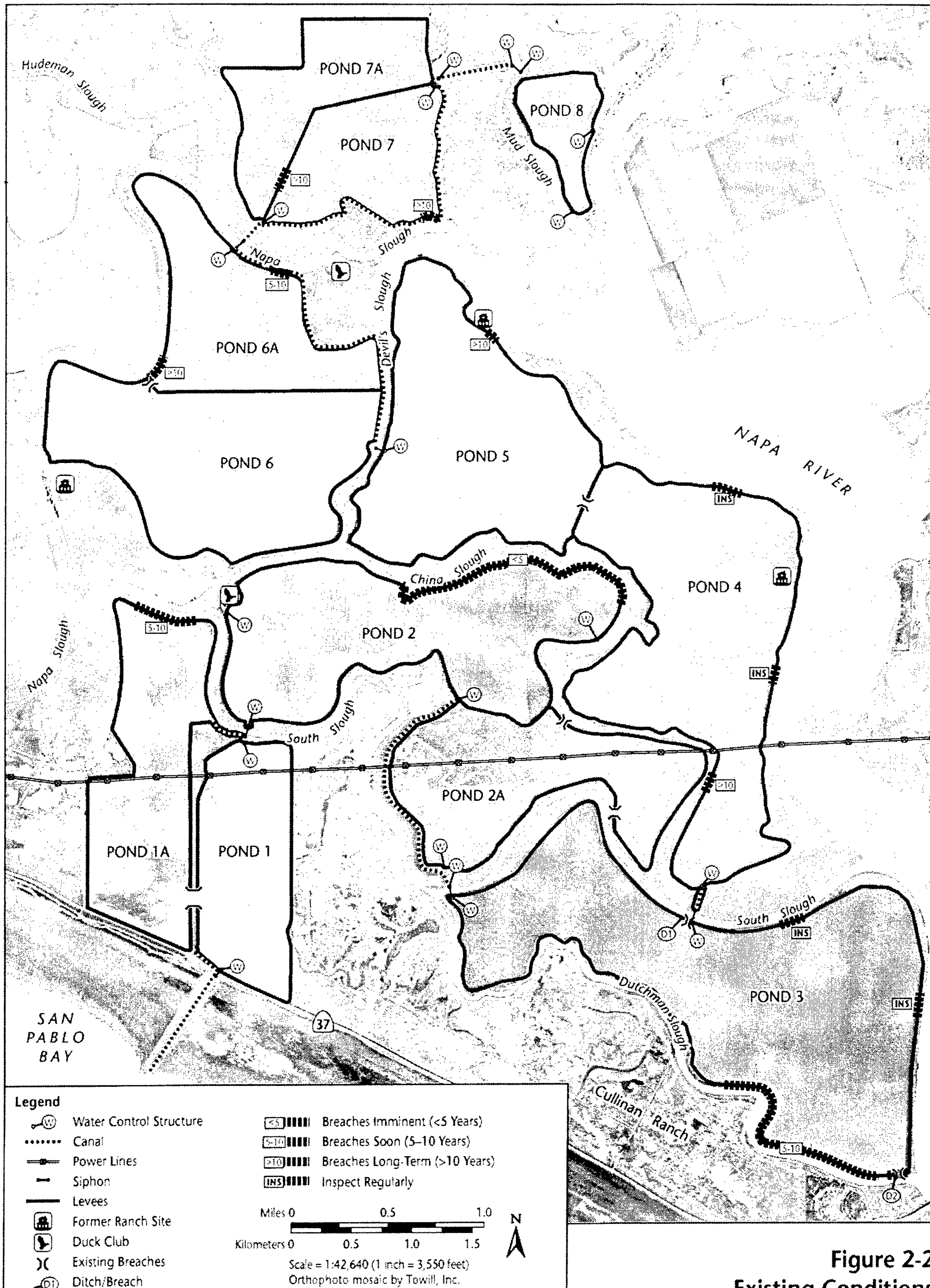

Figure 2-2
Existing Conditions

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Location

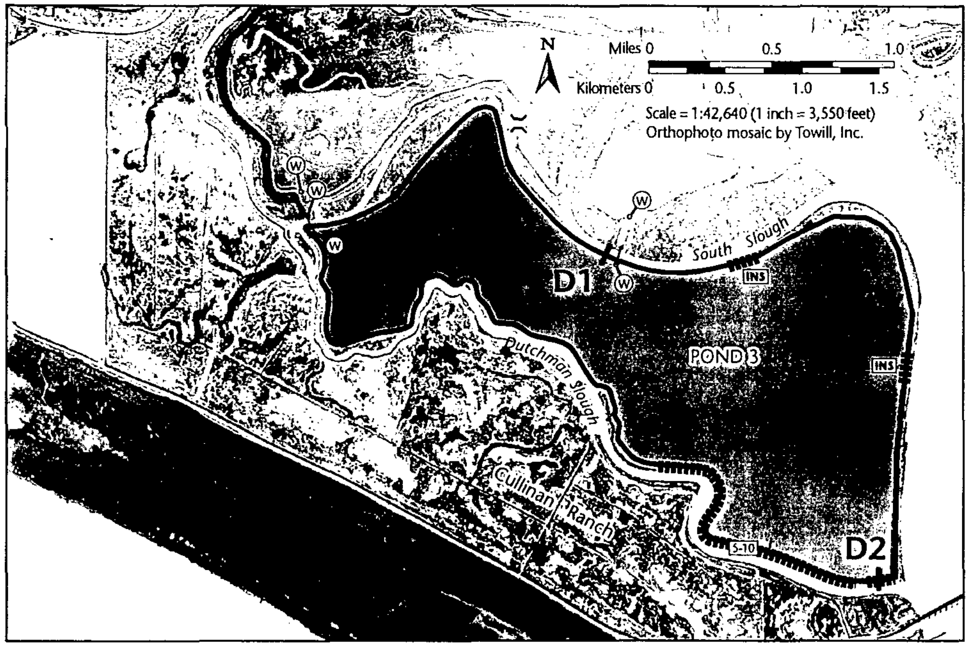

Photo of D1 (August 2002)

Photo of D1 (April 2003)

About the Ditches:

In August 2002, an unknown party dug a small 2-foot wide ditch between Pond 3 and South Slough (D1). DFG subsequently obtained an emergency exemption to create a small 2-foot-wide ditch on the southeast side of Pond 3 to facilitate better circulation of water in and out of Pond 3 (D2). The initial ditch was not repaired because of the cost of filling in the ditch and because the pond may be breached in the future. No adverse water quality effects have been identified; however, if adverse water quality effects are detected, the ditches will be repaired. The breaches' effects on the pond were limited until mid-December (December 13–20, 2002), when the combination of a large storm and tides widened the breach to South Slough.

Water Quality Sampling:

USGS started monitoring salinity and other water quality parameters soon after the ditches were created, collecting data within Pond 3 and outside the ditches. Initial salinity within the sloughs was approximately 20 parts per thousand (ppt) and within the pond was approximately 60 ppt. Pond salinity is now at ambient conditions (20 ppt) ~~still near 60 ppt and the ditches are having a very slow effect on salinity. No change in the salinity in the sloughs can be detected within 5-20 feet of the ditches.~~ Additional monitoring and sampling is ~~planned for 2004~~ ongoing (Schoellhamer pers. com.).

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Figure 2-2a
Ditches Excavated in Pond 3

Table 2-1. Approximate Pond Acreage and Percentage of Total Site Acreage

Project Area	Acreage			Pond Percent	Site Percent
	Pond Area	Levee Area	Total		
Pond 1	371	12	383	5%	
Pond 1A	573	17	590	8%	
Pond 2	738	22	760	11%	
Pond 2A	525	19	543	8%	
Pond 3	1,255	29	1,284	18%	
Pond 4	907	27	934	13%	
Pond 5	742	18	760	11%	
Pond 6	721	16	737	10%	
Pond 6A	425	18	443	6%	
Pond 7	306	11	317	4%	
Pond 7A	306	13	319	4%	
Pond 8	112	7	119	2%	
Subtotal:	6,981	210	7,190	100%	76%
Fringing marsh and slough:			2,270		24%
Total (DFG property):			9,460		100%

For the purpose of this document, Ponds 1, 1A, 2, 3, 4, 5, 6, and 6A are~~will be~~ referred to as the *lower ponds*. Ponds 7, 7A, and 8 are~~will be~~ referred to as the *upper ponds*. The lower ponds are located south of Napa Slough; the upper ponds are located north of Napa Slough. Pond salinity ranges and pond bottom elevations are depicted in Figure 2-3. Detailed site topography information was collected and used for the project as described in Chapter 3, "Hydrology." Additional pond salinity and water quality information is provided in Chapter 4, "Water Quality."

In 1995, Pond 2A was breached by DFG and allowed to restore to tidal marsh. A baseline monitoring of the recovery of this pond performed between 1996 and 2000 revealed that overall vegetation cover increased dramatically from 10% coverage to 90% coverage within 5 years (MEC Analytical Systems 2000).

In addition, in August 2002, an unknown party dug a small 2-foot-wide ditch between Pond 3 and South Slough. While this ditch provided some water exchange in Pond 3, it also is located very close to the siphon leading from Pond 3 to Pond 4 and, it was feared that as ~~if~~ it widend~~s~~, it could undermine the siphon, leading to a possible release from Pond 4. DFG ~~subsequently~~therefore obtained an emergency exemption to create a small 2-foot-wide ditch on the southeast side of Pond 3 to take the pressure off of the ditch on South Slough, by facilitating some circulation of water in and out of Pond 3. ~~USGS is currently monitoring salinity within and outside the small ditches. Initial findings indicate that the small amount of tidal exchange that occurs through these ditches has a negligible effect on water quality in the adjacent sloughs (Schoellhamer, pers. comm.).~~

Initially, salinity increases in South Slough were limited to a localized area near the original breach. In Pond 3, the water level rose because of tidal pumping, which altered salinity, temperature, dissolved oxygen (DO) and pH. However, the breaches' effects on the pond were limited until mid-December (December 13–20, 2002), when the combination of a large storm and high tides widened the breach to South Slough. Within 1 week of the storm, rainfall and increased tidal action lowered the salinity of the pond from 45 ppt to 20ppt, the background level in the Napa River. There was no detectable increase in salinity downstream of the breaches in Mare Island Strait or in Carquinez Strait. However, a salinity pulse persisting for 10 days was detected on the edge of a barotropic convergence zone 6 km to the west of the South Slough breach, about half way between the Napa River and Sonoma Creek. Because of dilution by slough water and continuing rain, the salinity at this location never exceeded 20 (which is equivalent to ambient summer conditions). (Schoellhamer pers. comm.).

The breach to South Slough has continued to widen to over 70 feet, and a scour hole has formed in the slough as much as 26 feet deep and 150 feet long to the east of the breach. The scour hole predominantly migrates eastward because flow rates east of the South Slough breach increased to as much as 160 m3/s (more than twice the flow rate than west of the breach) to accommodate the tidal prism of Pond 3. In Pond 3, borrow ditches and relict channels near the breach also have been scoured by this increased flow. Minimal erosion has occurred at the second breach at Dutchman Slough, and water exchanges at this location are minimal because the thalweg of this breach is higher than that of the breach to South Slough. (Schoellhamer pers. comm.).

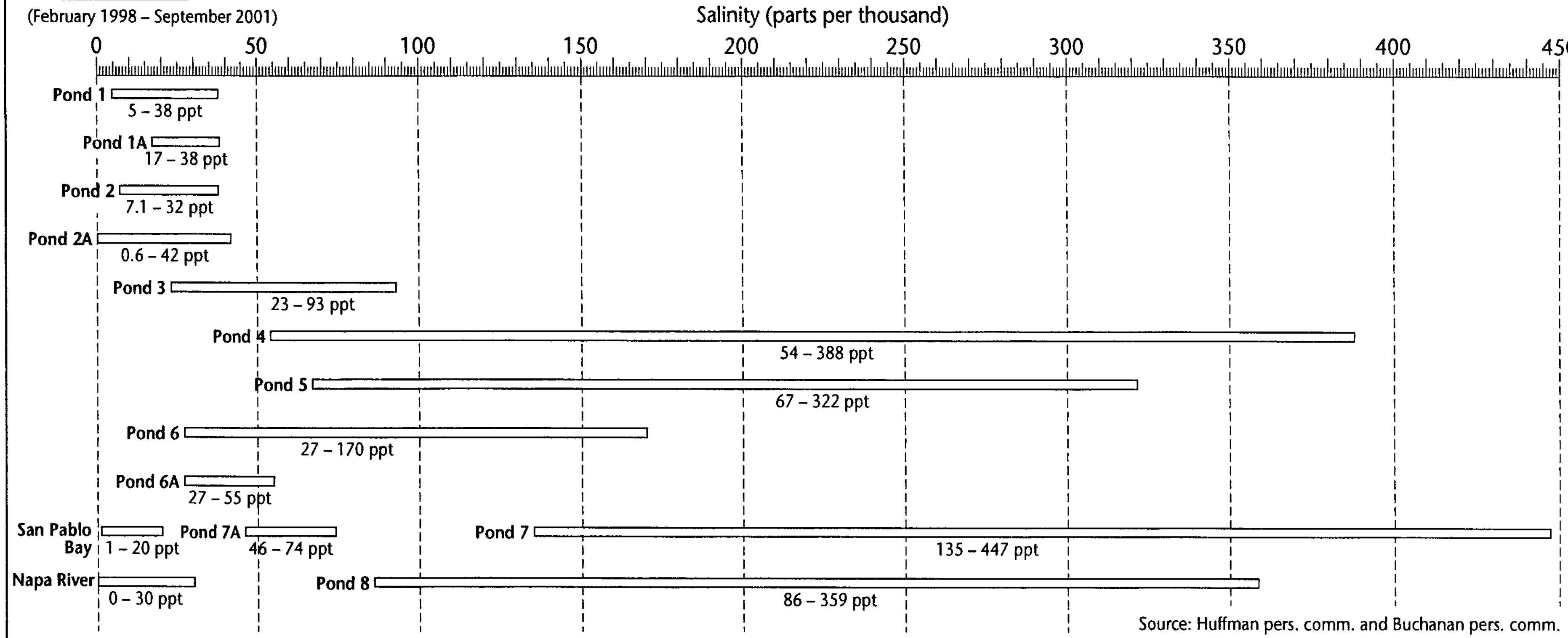
2.2.4.2 Levees

The levees in the project area are deteriorating in multiple locations (Figure 2-2). In some areas, levee deterioration is a result of erosion of the inboard slope because of wind/wave action in the pond, and in other instances levee deterioration is a result of tidal fluctuation and scour of the outboard portion of the levee.

Because the levees were constructed with native bay muds, they are more vulnerable to erosion from wind/wave action and tidal inundation than they would have been had they been constructed with engineered fill. The results of a preliminary geotechnical survey of the levees and a report from the on-site manager are depicted in Figure 2-2. These indicate the following conclusions:

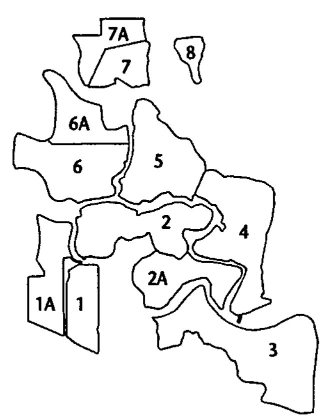
- Ponds 1 and 1A have effectively become one large pond because of a breach between the two ponds. The eastern levee of Pond 1 needs to be reinforced in the next 5 years as it serves as an important staging area for individuals who need to access the pumphouse and caretaker facilities. The levee is also used as a parking lot by members of the Can Duck Club. The northern levee of Pond 1A bordering South Slough needs reinforcement or it may be lost.
- The north and northeast levees from Pond 2 are likely to breach in the next 5 years unless they are repaired. Because of the high wind/wave action and

Salinity Ranges

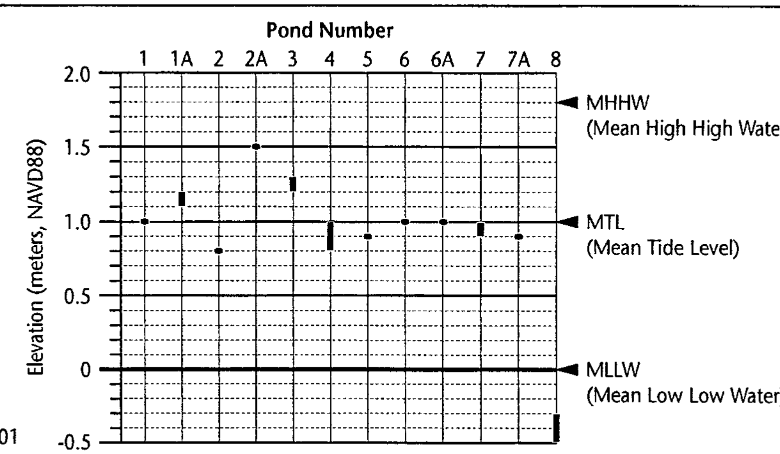


Source: Huffman pers. comm. and Buchanan pers. comm.

Pond Numbers



Pond Bottom Elevations



Source: Philip Williams Associates 2001

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Jones & Stokes

PWA

Figure 2-3
Salinity Ranges and Pond Bottom Elevations

past inability to regulate water levels in this pond, the crest of the levee is only 4–5 feet wide and has been undercut 2–3 feet in some areas.

- Approximately one-third of the eastern portion of the levee along the southern edge of Pond 3 is likely to breach within the next 5–10 years.
- Levees along the outside bends of Ponds 3, 4, and 5 have obvious scour/steep banks and are vulnerable to levee breaching in the next 5–10 years.
- There is substantial erosion of the outboard levee toe along Napa Slough on the west side of Pond 6A, just north of the dividing levee between Ponds 6 and 6A. There is also erosion on the north levee of Pond 6A, including the outboard toe into Napa Slough on the outer levee of the canal that runs along the north and east levees of Pond 6A. This section of levee (±100 feet) is high and narrow with a steep drop-off into the slough. The majority of the west and north levees of Pond 6A have strips of accreted marsh protecting the existing levees.
- Significant erosion from wind/wave action is apparent at the levee between Ponds 7 and 7A.

2.2.4.3 Water Control Structures

A variety of water control structures are used throughout the site including pumps, canals, siphons, “donuts,” tide gates, breaches, and borrow ditches. These structures are described below.

Pumps

Two large pumps move water throughout the pond system. There are two 15,000-gallon-per-minute (gpm) pumps in the northern portion of Pond 1 and a 6,000-gpm pump adjacent to the Napa River next to Pond 8. Generally, these pumps are operated in the evenings and on weekends (when electricity prices are lower to minimize pumping costs), during the appropriate tides, to bring water onto the site though the pump near Pond 8 has rarely been used since 2003. The operating time for the pumps is dependent on availability of DFG funds. In addition, DFG has just completed the installation of a new water control intake structure on the south side of Pond 8. The rate of intake at this structure is driven by the tide; the average (root-mean-square [RMS]) flow rate for this water control structure is estimated to be 9,000 gpm.

The pump/intake system is capable of moving water throughout the pond system by building head (water height) elevations in successive ponds (i.e., the water pressure from one pond would force the water into the next pond via a siphon). Recently, moving water through the system has become difficult because the salinity differential between the ponds created a reverse density gradient, requiring more head pressure than is possible within a pond. The problem is exacerbated by the development of a “saline wedge” in the bottom of the siphon. A *saline wedge* is viscous, dense brine that forms in the siphon when the denser,

heavier saline water falls to the bottom of the siphon and blocks the passage of water. Preliminary assessments undertaken in the feasibility study indicate that the pump system is largely incapable of controlling salinity levels in the summer though the new Pond 8 intakes are beginning to help this problem. In winter periods precipitation levels greatly enhance the ability of the pumps to maintain water levels and manage salinity.

Canals and Culverts

Four primary canals allow the distribution to and bypass of some of the salt ponds (Figure 2-2). Beginning from the southern portion of the site, the intake canal extends from San Pablo Bay into Pond 1 through a culvert under State Route (SR) 37. Water in this canal is tidally driven. The "All American Canal" conveys water from Pond 2 into Pond 3, bypassing Pond 2A. There is, however, some limited flow from Pond 2A to Pond 3 via the All-American Canal. There is a 42-inch water control structure (the old drain of Pond 2A) at the southwest corner of Pond 2A at the canal. At high tides in Pond 2A a redwood flap gate opens that delivers water into the canal and from there to Pond 3.

The remaining two canals are in the northern portion of the site, with a canal on the northeast side of Pond 6 and 6A and a canal along the southern and eastern sides of Pond 7 that connects to a large canal that leads to Pond 8.

Siphons

Siphons are large pipes, ranging from 36 to 72 inches in diameter, that convey pond water under sloughs between adjacent ponds. There are six siphons on-site: from Pond 1 to Pond 2; All American Canal to Pond 3; Pond 3 to Pond 4; Pond 5 to Pond 6; Pond 6A to canal (under Napa Slough); and canal to canal under Mud Slough (Figure 2-2). There is also a pipeline under the Napa River that allows DFG to receive water from Cargill on the east side of the river.

Because of the effects of a reverse salinity gradient and the formation of a saline wedge, the siphons between Ponds 3 and 4 and Ponds 5 and 6 often become clogged. However, in December 2003 the siphons were unclogged and have remained unclogged since.~~The siphon between Ponds 3 and 4 is currently clogged, and the siphon between Ponds 5 and 6 only recently became unclogged when winter rains began. Prior to the rains, the siphon did not operate for 1 year~~.

Donuts

Donuts are circular water control structures that have multiple intakes. They are used to distribute water through the canal and siphon system. Donuts are located where canals and multiple ponds intersect. They are found at Pond 1, Pond 2, Pond 6A, and Pond 7/7A in the northeast and southwest.

Tide Gates and Other Gates

Pond 2 has two tide gates. The tide gate on the west side allows both intake and discharge of water from the adjacent slough; the tide gate on the east side allows discharge only. Pond 1 has electronic tide gates that can be manipulated to obtain desired water elevations depending upon the tides. Other manually operated gates allow the DFG site manager to direct water to specific ponds. These gates are located at all donuts and siphons. The gate between Ponds 5 and 6 is no longer functional; water flow between Ponds 5 and 6 currently cannot be controlled.

Breaches

A series of intentional and unintentional breaches occurs throughout the pond system, increasing circulation between the ponds (Figure 2-2). Intentional breaches were created to avoid levee failure and allow the restoration of Pond 2A. An intentional breach also was created on the levee between Ponds 4 and 5 because of impending levee failure. Unintentional breaches have occurred in the levees between Ponds 1 and 1A and Ponds 6 and 6A.

Borrow Ditches

Internal to each pond, adjacent to the levees, are borrow ditches. These ditches were formed when native bay muds were excavated to create and later maintain the levees. These ditches continue to convey water when pond water levels are very low.

2.2.4.4 Recreation Facilities

There are few recreation facilities on-site because of the area's rural conditions, wildlife habitat, and lack of roads. DFG manages two parking lots for recreational access; one is on the northern side of Pond 1 and the other is north of Pond 7A. DFG also leases Pond 2 to the Can Duck Club for waterfowl hunting and fishing. The Can Duck Club is a private duck club with 50 member families. The duck club facilities include a small clubhouse on the southwestern shore of Pond 2 and several hunting blinds around the pond. There is also a privately held duck club on the northeastern portion of the island on which Pond 6A is located. This parcel is privately owned. There are two public boat ramps just outside the project area that allow reasonably good boat access to the sloughs. One is at Cuttings Wharf and the other is on Hudeman Slough. There is also a parking lot at the south end of Pond 8 (at the end of the road between the pond and the houses).

2.2.4.5 Easements and Other Agreements

The Can Duck Club maintains a lease on Pond 2 that will expire in June 2007~~is being updated~~. ~~DFG has requested a rental fee evaluation from the Wildlife Conservation Board (WCB) and asked the WCB to extend the Can Duck Club's lease for an additional 5 years.~~ As in the previous lease, DFG will require the duck club to do facility maintenance and special projects for rental credit. When the time comes that the lease is no longer renewed, the pond will be opened to the public for duck hunting and fishing opportunities.

Pacific Gas & Electric Company (PG&E) maintains 12-kilovolt utility lines in a utility easement across the southern portion of the site through Ponds 1A, 1, 2A, and 4.

~~DFG has a contract with Cargill to pump water from the east side of the river to the canal north of Pond 8. DFG typically pumps as much water as possible during the summer months until the contract amount has been fulfilled.~~

2.3 Habitat Restoration Project Goals and Objectives

The project sponsors have developed goals and objectives for the Napa River Salt Marsh Restoration Project. These include both habitat restoration goals and other related goals. The other opportunities provided by the project include the opportunity to beneficially reuse recycled water and the opportunity to enhance recreational options.

Habitat restoration goals are described first, followed by goals for recycled water use and recreation.

2.3.1 Habitat Restoration Goals

Habitat restoration goals were developed by the project team after careful consideration of and integration with the *Baylands Ecosystem Habitat Goals* report (Goals Project 1999). Overarching and project-site goals are described below.

2.3.1.1 Overarching Goals

The project sponsors developed the following overarching goals:

- Restore a mosaic of diverse habitats that will benefit a broad range of fish, wildlife, and plant species, including endangered and threatened species, fish and other aquatic species, and migratory shorebirds and waterfowl.

- Restore natural, self-sustaining systems that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention.
- Implement habitat restoration using adaptive management techniques.
- Recognize constraints, which are a driver in determining restoration objectives.
- Evaluate the restoration from a regional perspective, as not all regional objectives can be addressed within the project boundaries.
- Protect special-status species, to the extent possible, during the restoration process.
- Restore habitats in the NSMWA that will change over time as a result of inherent dynamic characteristics of the estuarine system (in terms of seasonal as well as longer-term changes).
- Phase the restoration in the project site and time the restoration in relationship with restoration projects throughout the NSMWA, particularly Cullinan Ranch and Skaggs Island, to reduce negative impacts (such as erosion of existing marshes and unintended breaching of levees) resulting from excessive changes in the tidal prism.
- Accelerate the speed of habitat restoration by conducting salinity reduction of the former salt ponds as quickly as is safely and financially possible.
- Meet as many of the goals and objectives of the *Baylands Ecosystem Habitat Goals* report as feasible, focusing on how this project's goals and objectives fit within the entire north bay region.

These goals were based on the *Baylands Ecosystem Habitat Goals* report (Goals Project 1999) (p. 97), which states:

> The overall goal for the North Bay is to restore large areas of tidal marsh and to enhance seasonal wetlands. Some of the inactive salt ponds should be managed to maximize their habitat functions for shorebirds and waterfowl, and others should be restored to tidal marsh. Tributary streams and riparian vegetation should be protected and enhanced, and shallow subtidal habitats (including eelgrass beds in the southern extent of this subregion) should be preserved or restored.
>
> Tidal marsh restoration should occur in a band along the bayshore, extending well into the watersheds of the subregion's three major tributaries—Napa River, Sonoma Creek, and Petaluma River. Seasonal wetlands should be improved in the areas that are currently managed as agricultural baylands. All remaining seasonal wetlands in the uplands adjacent to the Baylands should be protected and enhanced.
>
> ...In total, the Goals for the North Bay subregion call for increasing the area of tidal marsh from the existing 16,000 acres to approximately 38,000 acres, and creating about 17,000 acres of diked wetlands managed to optimize their seasonal wetland function.

The project will also help achieve the California Bay-Delta Program multi-species conservation strategy targets by restoring slough, marsh, and deeper open-water areas. These restored habitats can aid many species that the Bay-Delta Program agencies have pledged to help recover.

2.3.2 Project-Specific Habitat Restoration Goals

Specific project-site habitat restoration goals developed by the project sponsors using recommendations for the Napa River and Sonoma Creek areas from the *Baylands Ecosystem Habitat Goals* report include:

- In a phased approach, restore large patches of tidal marsh that support a wide variety of fish, wildlife, and plants, including
  - special-status mammals and water birds, specifically the salt marsh harvest mouse, California clapper rail, and black rail;
  - endangered fish, specifically Delta smelt, splittail, steelhead trout, and chinook salmon, and other fish species; and
  - aquatic animals, including the dungeness crab, and other benthic and planktonic invertebrates.
- Ensure connections between the patches of tidal marsh (in the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.
- Restore tidal marsh in a band along the Napa River to maximize benefits for fish and other aquatic animals.
- Manage water depths of ponds to maximize wildlife habitat diversity, with shallow-water areas for migratory and resident shorebirds and dabbling ducks and deepwater areas for diving benthivores.
- Manage salinity levels in ponds to support a rich diversity of biota.
- Break up unneeded levees to create refuges for roosting and nesting shorebirds.
- Manage invasive plant species, as feasible.

2.3.3 Beneficial Reuse of Recycled Water

The recycled-water-reuse goal for the project is to maximize use of available recycled water for salinity reduction ~~desalination~~. SCWA has formed a coalition of north bay water agencies with the intent of achieving 100% reuse (zero discharge) of recycled water. Minimizing discharge of recycled water is a requirement imposed by the State of California. It is the coalition's goal to divert 15,000 acre-feet (af)/year of recycled water from discharge to surface water bodies to beneficial upland reuse.

The overall concept is to construct a pipeline from all of the major treatment facilities in the north bay region to the agricultural users in Napa and Sonoma Counties. In the long term, the ability to transport water from west to east through the proposed pipeline would mean that agricultural users would have access to recycled water rather than using surface water from small streams and creeks in the north bay. The use of recycled water is appealing to agricultural users because the supply is consistent from year to year. If the pipeline is not built, each wastewater treatment plant (WWTP) would look for local reuse opportunities, but these reuse opportunities may not be sufficient to achieve zero discharge.

In the short term, a portion of the recycled water could be made available to the Napa River Salt Marsh Restoration Project to enhance desalination. The pipeline would be constructed in stages, and the amount of water initially available would be between 6,000 and 7,000 af/year. While reuse of recycled water for the project would not meet the long-term goal of zero discharge (i.e., the recycled water would eventually still be discharged to the Napa River or San Pablo Bay), use of the recycled water for salinity reduction ~~desalination~~ would be a beneficial reuse. This water would be especially valuable as a means of further diluting bittern (i.e., increasing the allowable bittern discharge rate). Reusing the recycled water for salinity reduction ~~desalination~~ would ensure that sufficient discharge capacity is available to accommodate the available volume of recycled water. The availability of discharge capacity would be crucial in the early phases of the recycled water project, and would enable coalition members to participate. After the salinity reduction process is completed, the pipeline constructed to the ponds would be modified by SCWA to provide irrigation water to nearby agricultural lands.

If recycled water is not used for salinity reduction ~~desalination~~, it is likely that the pipeline would not be built. The timing for deciding to use recycled water is crucial, as the WWTPs are currently in need of immediate reuse opportunities for a portion of their water.

2.3.4 Recreation

The NSMWA currently provides limited recreational facilities, as described above. The project goals include enhancing recreational access to and use of the project area by providing improved recreational facilities. Proposed improvements to recreational facilities may include interpretive signs, an information kiosk, paved and lighted parking areas, a toilet, improved footpaths to the ponds, and a wildlife viewing blind.

2.4 Development of Options

2.4.1 Introduction

The Napa River Salt Marsh Restoration Project includes three primary components—salinity reduction, habitat restoration, and water delivery. Each of these components had numerous approaches to being implemented. The following sections describe the screening process that was used to focus the ~~EIR/~~EIS and define a reasonable range of alternatives.

2.4.2 Options as Components of Alternatives

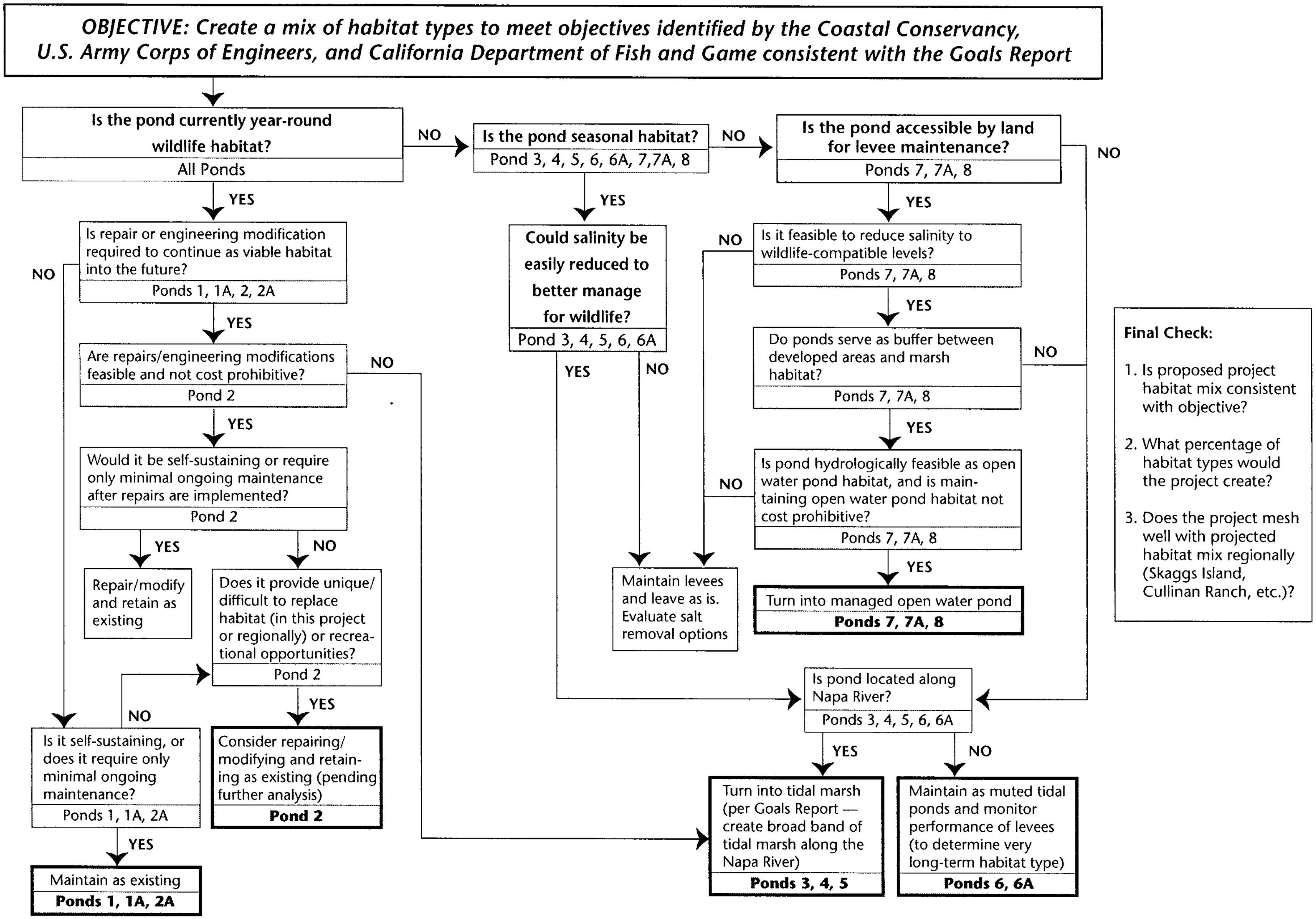
Because of the complexity of the salinity reduction and habitat restoration processes and the project sponsors' desire to select the best salinity reduction and habitat restoration approaches, this ~~EIR/~~EIS separates the components of alternatives into salinity reduction, water delivery, and habitat restoration options. These options are screened and analyzed separately, then combined in Chapter 17, "Alternatives," to arrive at a reasonable range of alternatives.

2.4.3 Screening Process

Several approaches were used to develop and screen options, including using a restoration decision flowchart developed by the project team (Figure 2-4) and the Corps' *Economic and Environmental Principles and Guidelines for Water Related Land Resources Implementation Studies* identified in the Corps' *Planning Guidance Notebook (ER 1105-2-100)* (U.S. Army Corps of Engineers 2000a), which includes screening based on effectiveness, efficiency, completeness, and acceptability. Environmental, economic, and social screening criteria were also used to evaluate and screen restoration components. This screening approach is relevant because the Corps will sponsor a portion of the project.

A wide range of options was identified and evaluated at a screening level. Options that were identified as viable in the first round of screening were retained for more detailed evaluation. Salinity reduction options were further subdivided into two components—the salinity reduction process, and supplemental (fresh or recycled) water delivery.

Preliminary screening of the salinity reduction options was achieved by conducting initial hydrologic modeling runs to determine the feasibility of various salinity reduction approaches. The water delivery options were evaluated by assessing the economic and institutional feasibility. The habitat restoration options were screened by characterizing the evolution of the site over time with varying assumptions. The most viable options were carried forward for consideration as potential project options. Potential habitat restoration options



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Jones & Stokes

Figure 2-4
Napa River Salt Marsh Restoration Project Decision Flowchart

were then presented to the Napa-Sonoma Marsh Restoration Group for review and critique.

2.4.4 Options Considered but Eliminated

Twenty-four salinity reduction, seven habitat restoration, and three supplemental water delivery options were considered at the screening stage. Of these, 21 salinity reduction options, three habitat restoration options, and two water delivery options were eliminated from further analysis because of criteria described above. These options are briefly described below.

2.4.4.1 Salinity Reduction Options

Reverse Operation of the Ponds

As described earlier, during the salt production process, bay water was moved from the southernmost ponds in sequence to the northern ponds. The initial salinity reduction options considered consisted of reversing the flow so that the higher salinity (northernmost) ponds would discharge into the lower salinity ponds (closest to the bay). Numerous permutations of this option were considered including reverse operation of all the ponds and reverse operation of selected ponds, as well as different discharge locations. Hydrologic modeling indicated that reverse operation would delay the salinity and habitat restoration process because desalination of the lower salinity ponds would be delayed until desalination of the higher salinity ponds had been completed. In addition, the salinity in the lower salinity ponds would increase initially as the water from the upper ponds is discharged to the lower ponds.

Concentration of Brine in One or More Central Ponds

Another option for conducting salinity reduction is to move brine from the lower and upper ponds to one or more centrally located ponds. The centrally located pond(s) would serve as a holding chamber(s) for the brine and would be used to discharge the brine over time. If all the brine were discharged to a small number of ponds, the remaining ponds could be restored sooner than under the reverse flow scenario. Several preliminary salinity reduction options used a version of this approach. Preliminary analysis of these options indicated that one or more ponds would have a very large increase in salinity, and (in several scenarios) one or more ponds could dry out completely. In addition, very high water volumes would be required for most of these options. The loss of habitat value and potential long-term damage to one or more ponds associated with desiccation made these options unacceptable.

Physical Removal of the Bittern

These options were developed to evaluate the potential for expediting the restoration of the upper ponds by speeding up the removal of bittern from Pond 7. Physical bittern removal would consist of pumping out and/or scraping up the contents of Pond 7 and then disposing of or reusing these materials off-site. Many variations of this option were considered, including ocean dumping, reuse, and land-based disposal. Cost and environmental effects made these options infeasible. If a purchaser can be found for bittern, this option may become economically feasible.

Use of Only Recycled Water to Desalinate All Ponds

This option was designed to eliminate potential impacts on aquatic life from use of Napa River, Napa Slough, or San Pablo Bay water for desalination. Water-balance calculations indicated that there would not be sufficient recycled water to compensate for net evaporation, much less to desalinate all ponds.

Flood Event Salinity Reduction

During high flow periods (i.e., flood events), a higher volume of water is available to dilute the brines from the ponds, and to carry the diluted discharge out of the river into San Pablo Bay. Under this option, brine could be discharged only during flood events, or, alternatively, could be discharged at a higher rate during flood events. This option is not a complete desalination option by itself, because this approach cannot be used for the bittern and may not be appropriate for the highest salinity ponds. The use of high-flow waters to help reduce salinity was integrated into Salinity Reduction Options 1B and 1C, as described below in Section 2.5.2.

Discharge of Diluted Bittern to San Pablo Bay

Another bittern dilution alternative considered was construction of a pipeline from Pond 7 directly to San Pablo Bay. This approach would result in discharge of more-concentrated effluent directly to San Pablo Bay. This option was considered infeasible for several reasons. First, the cost of constructing and operating such a system would be much greater than the costs associated with the other salinity reduction options. The costs would be associated with the multiple miles of pipeline itself, the chemically resistant materials required for the pipeline, the cost of constructing in areas that are not land-accessible (Ponds 6, 6A, and 2), the cost of boring through or under numerous levees (or creating engineered footings for an elevated pipeline), and the cost of pumping the heavy effluent from Pond 7 into San Pablo Bay. In addition, to ensure sufficient dilution, the discharge pipeline most likely would have to be extended to the deepwater channel (the relatively concentrated brine could not be discharged into the very shallow areas of San Pablo Bay immediately south of the project area).

This would further increase costs and construction challenges. Secondly, the environmental effects of constructing and operating such a pipeline would be significant for the reasons just discussed. Thus, this alternative was eliminated.

Mixing Bittern with High Salinity Brine to Reduce Toxicity

Testing indicated that mixing bittern with high salinity brine did not reduce the toxicity sufficiently to allow an increase in discharge rates (GAIA 2002); therefore, an alternative consisting of mixing bittern with high salinity brine was eliminated. (These results are discussed in more detail in Chapter 4, "Water Quality," Section 4.1.4.5).

Move Bittern to East Side Ponds

Because of the recent acquisition of the east side Napa River salt ponds by DFG, a new alternative has become available. This alternative consists of physically moving bittern from Pond 7 to one or more ponds on the east side of Napa River. However, transferring bittern from Pond 7 to the wash ponds on the east side of the Napa River was deemed infeasible. While this approach would accelerate restoration of Pond 7, it would create similar bittern removal concerns for the new storage location. In addition, the transfer of bittern to the east side of the river either would require costly construction of a pipeline or would spread the bittern through the entire canal between Pond 7 and the pipeline leading under the Napa River. Furthermore, while the land on the east side of the Napa River is now owned by DFG, Cargill is currently removing stockpiled salt in preparation for restoration of the property. This process requires access to all the ponds, including the wash pond, for approximately the next 7 years (Ransom pers. comm.). Using one or more of the ponds on the east side of the Napa River to store bittern would simply delay the restoration process for that project.

2.4.4.2 Water Delivery Options

Using fresh (nonsaline) water in the salinity reduction process would expedite the salinity reduction process, thus requiring less time to accomplish salinity reduction.

Maximum Recycled Water Delivery

As discussed earlier, recycled water is potentially available to the Napa River Salt Marsh Restoration Project from WWTPs in the north bay region. The Maximum Recycled Water Delivery Option assumes that the water/sanitary agencies in the region would provide a combined 15,000 af/year of recycled water for salinity reduction. This volume would require most of the recycled water that is not currently slated for other uses, and would also require the installation of a pipeline to allow for the delivery of water from as far away as

eastern Marin County. The feasibility and timing of constructing a pipeline system to convey recycled water to the project site from all WWTPs in the north bay region have not been determined. As such, the Maximum Recycled Water Delivery Option is not considered feasible at this time; however, a portion of this option is currently feasible, as described below under Section 2.5.3, "Water Delivery Option."

Use of Site Groundwater

Another potential source of fresh water for salinity reduction is the groundwater beneath the site. Reportedly, when hay production was occurring in the project area, groundwater was used for irrigation. This option was eliminated from further consideration because of the relatively small volume of water available, the cost of installing the required wells and water distribution system, the risk of causing saltwater intrusion into the shallow aquifer, and the opposition of the San Francisco Bay RWQCB to use of limited potable water for desalination when other options are feasible. However, use of groundwater may be appropriate for select aspects of the long-term maintenance program for the project area.

2.4.4.3 Habitat Restoration Options

Species-Focused Options

Species-focused options consist of restoring the site for primary use by specific species such as waterfowl and shorebirds or by endangered species. If the site were managed primarily for diving benthivores and other waterbirds, it would remain entirely as ponds. If the restoration were focused primarily on endangered species such as the California clapper rail, the site would be converted to tidal marsh in its entirety.

Maximizing habitat for shorebirds and waterfowl would completely eliminate the largest likely potential for recovery of endangered species and the largest likely potential for increasing tidal marsh and associated ecosystem services (including benefits to the bay) anywhere in the north bay region. The Bay-Delta estuary has lost ~~79%~~ 85–90% of its tidal marshes, to the serious detriment of not only many tidal marsh species, but also the bay as an ecosystem. This loss of potential benefits would be grossly in conflict with the Habitat Goals and with federal and state plans for endangered species recovery, and would be widely considered unacceptable.

Maximizing habitat for endangered species would cause disproportionate negative impacts on shorebirds and waterfowl by eliminating excellent high tide refugia and feeding habitat for the former and substantial feeding and resting habitat for the latter. These impacts are particularly important because of the project's location on the Pacific Flyway. These impacts are considered unacceptable to the project sponsors and many others.

Thus, these two options do not provide suitable habitat for the large diversity of species currently residing in the NSMWA, and therefore do not meet project goals. In addition, species-focused options are particularly difficult to design and do not allow the flexibility needed to manage the multispecies project area. For example, managing ponds for shorebird use (i.e., maintaining shallow water levels) is very difficult given the large area of the ponds and the high evaporation rates that occur in the summer months. The habitat restoration options that were retained provide suitable habitat for a wide range of existing species.

Land Exchange

One possibility for optimizing habitat development in the region is to integrate activities at adjacent or nearby restoration sites. Specifically, Cullinan Ranch, which is owned by USFWS, is deeply subsided, yet is slated for redevelopment into tidal marsh. One possible option is to exchange the Cullinan parcel for a DFG parcel in the project area so that land more suitable for tidal marsh restoration is used to create tidal marsh and a deeply subsided area such as Cullinan Ranch is used to create pond habitat. This habitat restoration option, although technically and economically sound, is logistically infeasible because the terms underlying congressional funding and USFWS's purchase agreement mandated that Cullinan Ranch be restored to tidal marsh.

Sediment-Import Options

Habitat restoration could be accelerated and/or seasonal wetland and upland habitat could be created with the import of large quantities of sediment. The sediment would be placed into the ponds before breaching to avoid or minimize the need for sediment accretion prior to the establishment of marsh vegetation. In addition, imported sediment could be used to raise grades at the northern ponds to create upland or seasonal wetland habitat. Large-scale sediment import was eliminated from consideration because sediment import may not enhance the environmental values substantially over existing conditions and because DFG supports only limited use of sediment. Additionally, initial calculations have shown that existing sediment supply is greater than the predicted postrestoration demand, indicating that there may be sufficient sediments to restore the ponds naturally (Philip Williams and Associates 2002a). Creation of seasonal wetland or upland habitat is not part of the goals for this project.

2.4.5 Options Evaluated in This ~~EIR/~~EIS

As described earlier, three sets of options are evaluated in this ~~EIR/~~EIS. Because both salinity reduction and habitat restoration are required to complete the project, the habitat restoration options are combined with appropriate salinity reduction options and water delivery options (Chapter 17, "Integration of Options and Alternative Selection") to document the full extent of potential impacts associated with complete alternatives. In addition, ~~both CEQA and~~ NEPA

requires evaluation of a no-project alternative. This section describes first the No-Project Alternative, then the salinity reduction options, the water delivery options, and the habitat restoration options. The options are described briefly below and in detail in Section 2.5, "Project Options."

- **No-Project Alternative.** Under the No-Project Alternative, site conditions would continue to deteriorate and salinity in the ponds closed to tidal influence would continue to increase. Additional No-Project Alternative assumptions are described in Section 2.5, "Project Options."
- **Salinity Reduction Option 1A: Napa River and Napa Slough Discharge.** This option proposes to conduct the salinity reduction process in a phased approach, decoupling desalination of the upper ponds from desalination of the lower ponds. Primary discharges from the upper ponds would be to Napa Slough, and primary discharges from the lower ponds would be to the Napa River. The use of recycled water for dilution of the upper ponds ~~may be~~ ~~is included in~~ can be added to this option.
- **Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3.** This option also proposes to conduct the salinity reduction by separating the upper and lower ponds. Primary discharges from the upper ponds would be to Napa Slough. Salinity reduction of the lower ponds would occur by creating a 50-foot breach on the Pond 3 levee during a high flow event and constructing an intake on Pond 5 and a discharge on Pond 4. The use of recycled water for dilution of the upper ponds can be added to ~~is included in~~ this option.
- **Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5.** This option is similar to Salinity Reduction Option 1B except that the Pond 4 levee would also be breached and the intake and discharge would not be constructed. Salinity reduction of the lower ponds would occur by strategically timing the levee breaches during a large storm event when the Napa River flow is high. The use of recycled water for dilution of the upper ponds can be added to ~~is included in~~ this option.
- **Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge.** This option also proposes to conduct the salinity reduction process in a phased approach; however, desalination of the upper ponds is coupled with desalination of some of the lower ponds. Primary discharges from the upper ponds would be conveyed through Ponds 6A, 6, 2, and 1/1A, then under SR 37 to San Pablo Bay. Primary discharges from Ponds 3, 4, and 5 would be to the Napa River. The use of recycled water for dilution of the upper ponds could be included in this option.
- **Water Delivery Option.** This option focuses on project-specific and programmatic delivery of recycled water to the project area. Project-specific delivery would occur from the Sonoma Valley County Sanitation District (SCVSD) WWTP, the Napa Sanitation District (NSD) WWTP, and the City of American Canyon (CAC) WWTP. Programmatic delivery could come from other WWTPs in the north bay region.

- **Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds.** This option provides a balanced mix of tidal marsh habitat and managed pond habitat, with an emphasis on restoring Ponds 3, 4, and 5 to tidal marsh and maintaining the remaining ponds as managed ponds. Ponds 6 and 6A would be managed as ponds in the short term (the initial 10–20 years). Adaptive management criteria would be used at that point to determine whether these ponds should also be opened to tidal action, or whether they should remain as managed ponds.
- **Habitat Restoration Option 2: Tidal Marsh Emphasis.** This option provides a larger amount of tidal marsh habitat and proposes to reconfigure the levee in Pond 2 because of deteriorating site conditions. Ponds 3, 4, 5, 6 and 6A, and the eastern half of Pond 2 would be restored to tidal marsh.
- **Habitat Restoration Option 3: Pond Emphasis.** This option provides a larger amount of pond habitat; only Ponds 3 and 4 would be restored to tidal marsh.
- **Habitat Restoration Option 4: Accelerated Restoration.** This option adds design features such as more extensive starter channels and berms, and the use of imported sediment to fill an area to near tidal marsh elevation, ~~and~~ to accelerate marsh restoration.

2.5 Project Options

2.5.1 No-Project Alternative

~~CEQA and~~ NEPA requires the analysis of a no-project alternative. The No-Project Alternative for this project is depicted in Figure 2-5. Under this alternative, site conditions would continue to deteriorate and salinity in the ponds would continue to increase. DFG would manage the site to reduce day-to-day pond salinity, if possible, by taking San Pablo Bay water into Ponds 1 and 1A and Napa River water into Pond 8 and moving water through the pond system via water control structures. Annually there would be a net increase in the total salt load.

Water would be delivered to the system from two locations: the new intake at Pond 8 and the pump station that transfers water from Pond 1 into Pond 2. The Pond 8 intakes are estimated to provide an average (RMS) flow of 20 cubic feet per second (cfs); the pump station has two 15,000-gpm-capacity pumps. The flow from the intakes to the remaining ponds is driven by elevation ("head") differential. Initially, the ponds would be expected to dry out more frequently as siphons continue to be or become inoperable as a result of increased salinity gradients. Other water control structures would continue to deteriorate, reducing DFG's ability to manage water levels and pond salinity for wildlife habitat. Thus, the quality of wildlife habitat in the area would continue to deteriorate quickly.

However, even more significant than the deterioration in wildlife habitat is the increased ecological threat that would be posed to the ponds in the next 10–15 years. If DFG attempts to maintain the ponds' water levels by compensating for annual net evaporation, the salt mass in the ponds would increase dramatically from year to year. In the short term, depending on the amount of make-up water available for each pond, some ponds could dry out each year. In the long term, the increasing salinity in the ponds would reduce evaporation rates sufficiently that the estimated available amount of water would be sufficient to keep the ponds wet all year. If the amount of water delivered to the ponds was kept the same, water levels would then slowly start to rise, and eventually water intakes would have to be cut back to avoid overfilling the ponds. However, salinities in the ponds at this point would exceed 350 ppt (the approximate solubility of sodium chloride), and sodium chloride would start to precipitate. As the salinity would increase, the liquid in the ponds would gradually turn into bittern; the sodium chloride would precipitate, and the remaining brine would have the same composition as the bittern waste left over after the saltmaking process.

Thus, if DFG attempts to manage the water levels in the ponds without discharging to the Napa River or Napa Slough, sufficient salt would accumulate in the ponds that Ponds 4–8 would turn first into highly saline brine and then into bittern ponds with a large precipitated salt mass. Coupled with the deterioration of the levees, the ponds would present an ecological threat in the next 5–30 years.

Ongoing erosion of inboard levees by wind and waves and scour of outboard levees, in conjunction with high tides and high rainfall events, would likely result in one or more levee breaches. Figure 2-5 indicates potential breach locations. DFG would potentially fix the levees on an emergency basis as needed, requiring the mobilization of construction equipment to the site. Because of the remote locations and emergency contracting issues (i.e., permits, funding, contractor availability), these repairs often cannot be started in a timely manner, and much of the potential damage (i.e., possible fish kills) resulting from uncontrolled releases of highly saline water or bittern would be instantaneous. By the time the levees were fixed (approximately 3–4 weeks), most of the negative effects already would have occurred, as large quantities of highly saline pond water/bittern would have been released. The Pond 3 vandalism will not be repaired because adverse effects are not anticipated, and it is consistent with the general salinity reduction approach that the project sponsors are pursuing.

Allowing the ponds to dry out is considered to be even less environmentally acceptable than continuing to increase the mass of salt in the ponds over time. If the ponds are allowed to dry out, the sulfides in the sediment would convert to sulfuric acid and reduce the pH in the ponds. This occurred at Pond 8 in 2001, and the pH ~~at Pond 8 now~~ range<u>d</u>~~s~~ from a low of 2.2 to a high of 4.2, depending on the quantity of water in the pond. Low pH also poses a substantial environmental risk, and could require even greater dilution prior to discharge than the bittern. <u>The current pH in Pond 8 is normal due in part to the new water control structure built in 2002.</u>

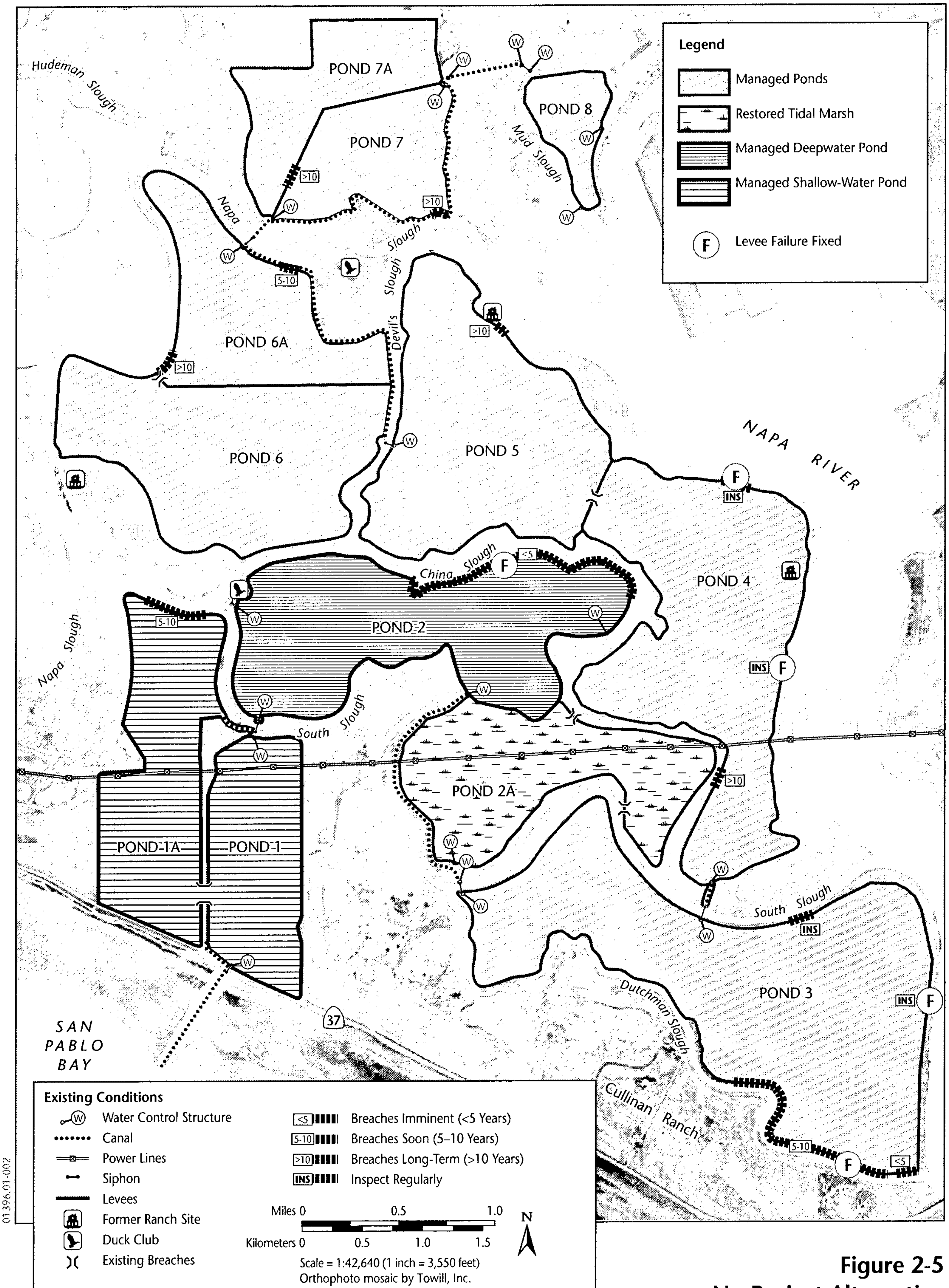

Figure 2-5
No-Project Alternative

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2.5.2 Salinity Reduction Options

Salinity reduction is the first step in the habitat restoration process. Currently, many of the ponds have salinities that either preclude use of the ponds by wildlife, or limit use of the ponds to a very small number of species seasonally. Reducing the salinities in the ponds to a level that makes the ponds usable for a wide range of wildlife would be the first step in enhancing the habitat value of the ponds. Generally, once the ponds are desalinated, they could be opened up to tidal action or maintained as managed ponds.

Salinity reduction is not currently required for Ponds 1, 1A, 2, and 2A. Ponds 1, 1A, and 2 all have salinities that are at or near ambient conditions (i.e., salinity levels near San Pablo Bay/Napa River levels), and Pond 2A has been restored to tidal marsh. Ponds 1, 1A, and 2 have water exchange (i.e., they can continue to function as ponds in the long term without salinity build-up in the ponds). Pond 3 is ~~partially~~ open to tidal exchange although it has a muted tidal range~~; however, because the ditches are so small, salinity reduction of Pond 3 still needs to be conducted~~. For the purposes of salinity reduction~~desalination~~, Ponds 4 and 5 are treated as one pond (the interior levee is breached), as are Ponds 6 and 6A for the same reason. Thus, salinity reduction is required for ~~six~~ five ponds: ~~Pond 3,~~ Pond 4/5, Pond 6/6A, Pond 7, Pond 7A, and Pond 8. Pond 3 is retained throughout the analysis as a reference point, though the site has evolved to background salinity conditions.

All salinity reduction options would use the existing water conveyance infrastructure to the degree possible. However, the existing water conveyance structures are deteriorated, and the engineering evaluation suggests that all siphons would require refurbishing or replacement. In addition, all options require construction and/or repair of intakes, outfalls, and other water conveyance structures (such as pumps, siphons, weirs, and fish screens).

The intakes would be equipped with fish screens, if required by USFWS and NMFS. Use of unscreened intakes and/or bypass of fish screens may be permissible for part of the year or specific ponds, or once certain salinity thresholds have been met. The physical location of each intake or set of intakes may affect the type of screens or whether a fish screen is required. Any fish screens would have trash racks and scrapers to remove debris. If fish screens are required, they would reduce the flowrate through a given intake by approximately 50%, thus doubling the required number of intake structures. This document uses the higher number of intake structures in assessing potential project-related impacts. If fish screens are not required, the resulting construction impacts would be less than described herein.

Any water control structures and other equipment installed for this project would be subject to highly corrosive environments, high turbidity, and impacts from debris. Water conveyance structures that will be used in the long-term (i.e., for ponds that have long desalination periods or will become managed ponds) will be constructed of HDPE and/or stainless steel to extend the life of the equipment as much as possible. It is estimated that HDPE pipe will last for the life of the

project; any structures requiring use of stainless steel, however (e.g., knife valves for intakes and outfalls) would likely last a maximum of 30 years. Because the planned project life is 50 years, any such equipment would have to be replaced at least once. The construction materials would reflect the need for a high level of corrosion resistance, and any electronic equipment required would be extremely rugged. Water conveyance structures required only for short periods of time (e.g., intakes on ponds that would be opened to tidal action in the near term) could be made of less ~~resistant~~ durable materials to reduce the construction impacts and costs (these structures would be lighter and easier to install).

A difficulty likely to be encountered with monitoring equipment and any other high value equipment is theft and vandalism. Experience with past monitoring efforts has shown that most monitoring equipment was stolen or vandalized within a matter of weeks. Thus, this type of equipment would have to be enclosed by high fences topped with razor wire. Fencing off monitoring and other electrical equipment would also eliminate any potential risks to the public associated with tampering with the equipment.

Levee repairs would be conducted at the start of the salinity reduction ~~desalination~~ period for those ponds requiring salinity reduction~~desalination~~. The amount of repairs required depends on the salinity reduction~~desalination~~ option selected, because different ponds would be desalinated at different rates under the different options (i.e., the duration for which the levees would have to retain their integrity, and which levees are required to retain their integrity, vary by option). For ponds that require more than 1 year~~a long time~~ for salinity reduction~~desalination~~ (e.g., Pond 7), levee maintenance would be required before and during the salinity reduction~~desalination~~ period. It is estimated that 5% of all levees would require repairs every year.

2.5.2.1 Salinity Reduction Option 1: Napa River and Napa Slough Discharge

Introduction

Salinity Reduction Option 1 is designed to create improved site conditions in the various ponds as quickly as possible. Under this option, salinity reduction in the lower ponds (3, 4/5, and 6/6A) would be achieved through a phased approach: restoration to near ambient Napa River salinity levels would begin at Pond 3, then continue to Ponds 4/5, and then proceed to Ponds 6/6A. As mentioned previously, Ponds 1, 1A, and 2 already have salinities at or near ambient conditions, and Pond 2A has been restored to tidal marsh. Pond 3 is retained throughout the analysis as a reference point, though the site has evolved to background salinity conditions. Salinity reduction in the upper ponds (7, 7A, and 8) would be carried out in a parallel phase.

With a phased salinity reduction process, each pond would achieve increased habitat value as soon as possible. Ponds that are slated to remain managed ponds would be fully functioning habitat as soon as salinity reduction is completed.

Each of the ponds that is slated to be opened up to tidal action could be opened up to tidal action as soon as its salinity and water quality parameters are in the appropriate range as determined by the San Francisco Bay RWQCB and other regulatory agencies.

One of the concerns associated with existing conditions at the Napa River Unit of the NSMWA is that one or more of the pond levees could breach and that that breach would result in an uncontrolled release of saline brine. Such breaches could occur at any time of year, as a result either of levee erosion caused by wind and waves or of high flow or flood events, but they are more likely to occur during high wind/rainfall events. These potential uncontrolled breaches are of most concern for the more saline ponds (i.e., Ponds 4/5 and 8) and the bittern pond (Pond 7), and for releases to the sloughs (which have a relatively low daily tidal exchange compared to the Napa River). However, controlled, managed breaches into the Napa River, especially for the less saline ponds, represent a potentially effective means of desalinating some of the ponds. The goal of the breaches proposed under this scenario would be to desalinate the ponds. Additional breaches would be added to allow for full tidal exchange and return the ponds to tidal habitats.

The portion of the Napa River adjacent to Ponds 3 and 4/5 experiences a significant daily tidal flow, which would result in a high dilution rate for brines discharged in this area. Modeling has shown that controlled breaches for the lower ponds can be an effective means of desalinating these ponds. Consequently, Salinity Reduction Option 1 has three suboptions: Option 1A, Option 1B, and Option 1C. These options use differing processes for desalinating Ponds 3 and 4/5 but the same process for desalinating Ponds 6/6A, 7, 7A, and 8:

- Option 1A, "Napa River and Napa Slough Discharge," uses constructed intakes and outfalls for all ponds, including Ponds 3 and 4/5. This option provides the most control over the rate of pond discharge and resulting salinity increases in the Napa River. The existing ditches <u>at Pond 3</u> would need to be repaired under this option.
- Option 1B, "Napa River and Napa Slough Discharge and Breach of Pond 3," uses a controlled levee breach to desalinate Pond 3 during a high flow event. The remaining intakes and outfall locations are the same as for Option 1A.
- Option 1C, "Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5," would desalinate both Ponds 3 and 4/5 via controlled levee breaches during high flow events.

The required construction activities, facilities, and operation and maintenance for Ponds 3 and 4/5 are described first, followed by the same information for Ponds 6/6A, 7, 7A, and 8.

The breaches proposed under Options 1B and 1C would eventually have to be created to return the ponds to tidal marsh. The advantages of using controlled breaches to desalinate one or more of the ponds would be as follows:

- much of the construction associated with ~~desalination~~ salinity reduction would be avoided,
- fish entrapment and other impacts on fish from intakes would be minimized,
- the ponds would be desalinated more quickly, and
- salinity increases in the Napa River would be of more limited duration.

Ponds 3 and 4/5

Construction

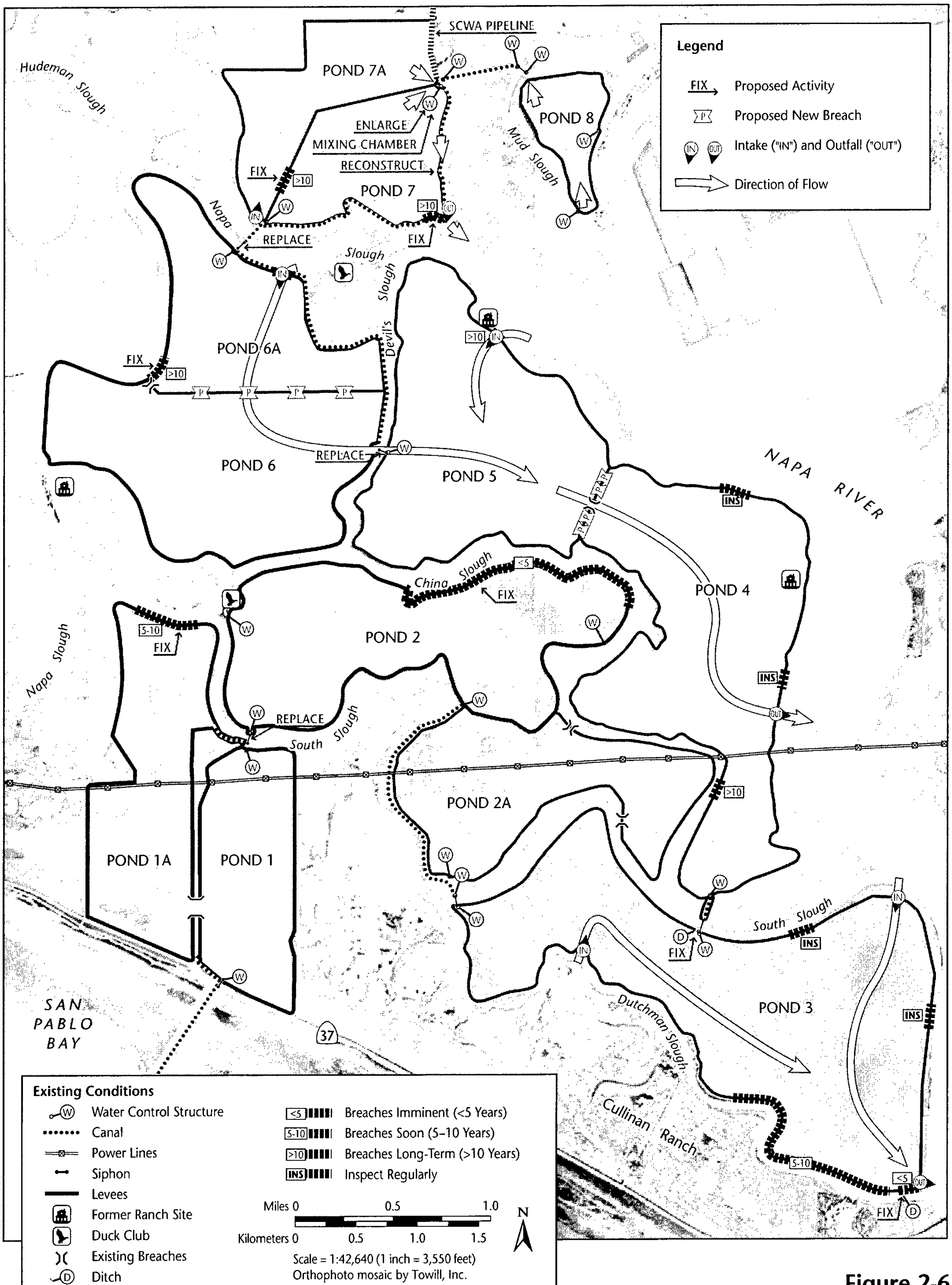
Facilities. New water intakes and water control discharge locations (outfalls) would be required so that an effective water circulation pattern could be established. For Salinity Reduction Options 1B and 1C, the breaches allow for tidal circulation. The anticipated intake and discharge (outfall) locations for each of the ponds are shown in Figures 2-6 through 2-8 for Options 1A through 1C, respectively. Intakes and outfalls would be constructed at locations that would minimize effects on existing marsh habitat and minimize the length of pipes needed (because they would take advantage of deepwater river or slough channels close to the levee). Interior levees would be breached using explosives where applicable. Exterior levee breaches would be constructed either using explosives or by excavating the levee. The ditches connecting Pond 3 to the adjacent sloughs would be repaired under Salinity Reduction Option 1A.

Intakes and Outfalls for Option 1A. New intake and outfall culverts would be built to connect

- the Napa River to the northeast corner of Pond 3 (four 52-inch intake culverts that bisect the levee and extend approximately 600 feet into the river);
- Dutchman Slough to the southwestern side of Pond 3 (three 48-inch-diameter intake culverts that bisect the levee and extend approximately 300 feet into the slough);
- the southeast side of Pond 3 to the Napa River (four 52-inch-diameter outfall culverts bisecting the levees and extending 1,100 feet into the river);
- Napa Slough to the north-central section of Pond 5 (seven 54-inch diameter intake culverts that bisect the levee and extend approximately 500 feet into the slough); and
- the south-central section of Pond 4 to the Napa River (two 48-inch-diameter outfall culverts bisecting the levees and extending 1,100 feet into the river).

Intakes and Outfalls for Option 1B. New intake and outfall structures would be constructed to connect

- the southeast side of Pond 3 to the Napa River (one 50-foot breach serving as both intake and outfall);



Jones & Stokes

Figure 2-6
Salinity Reduction Option 1A:
Napa River and Napa Slough Discharge

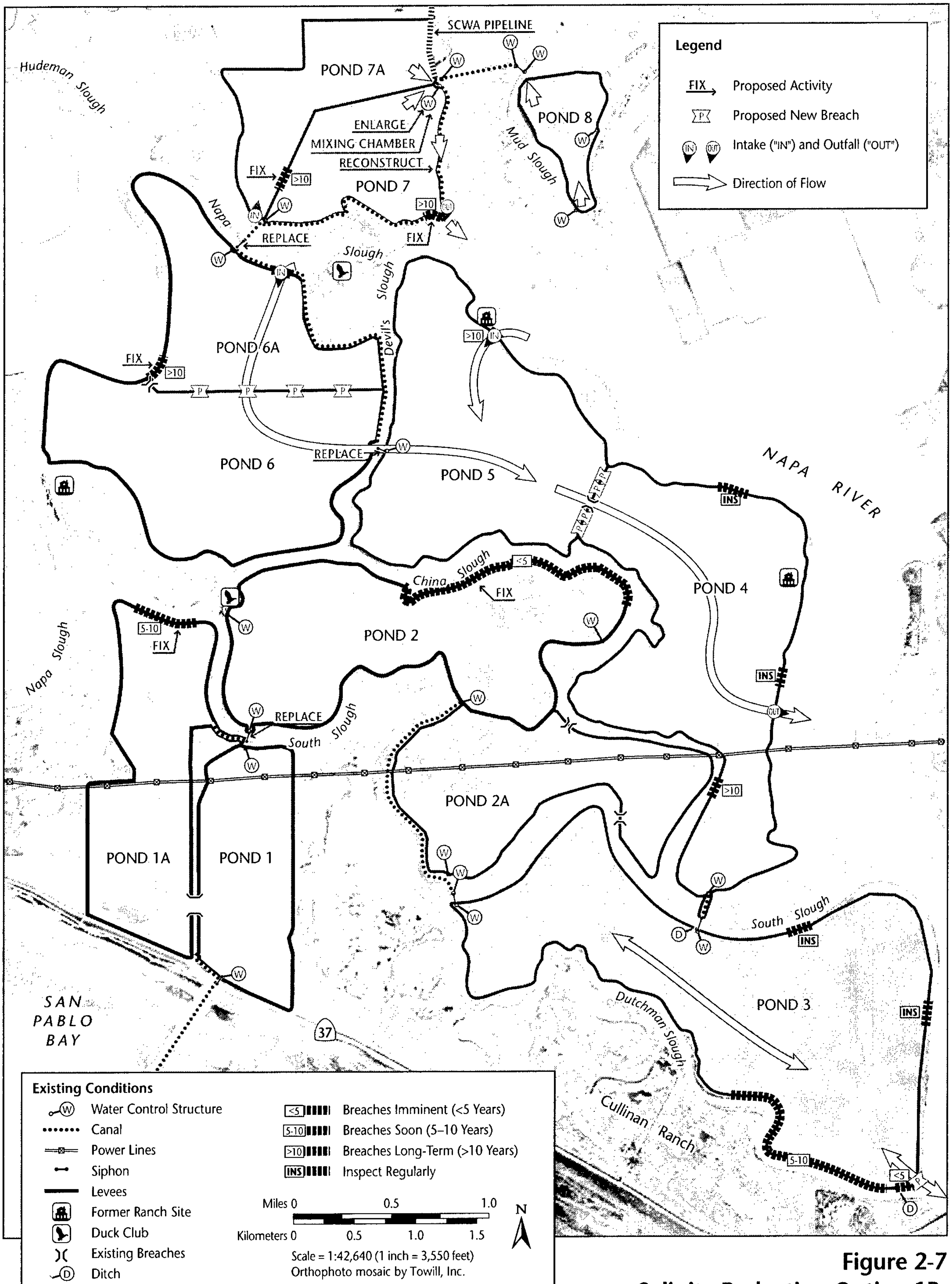


Figure 2-7
Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Jones & Stokes

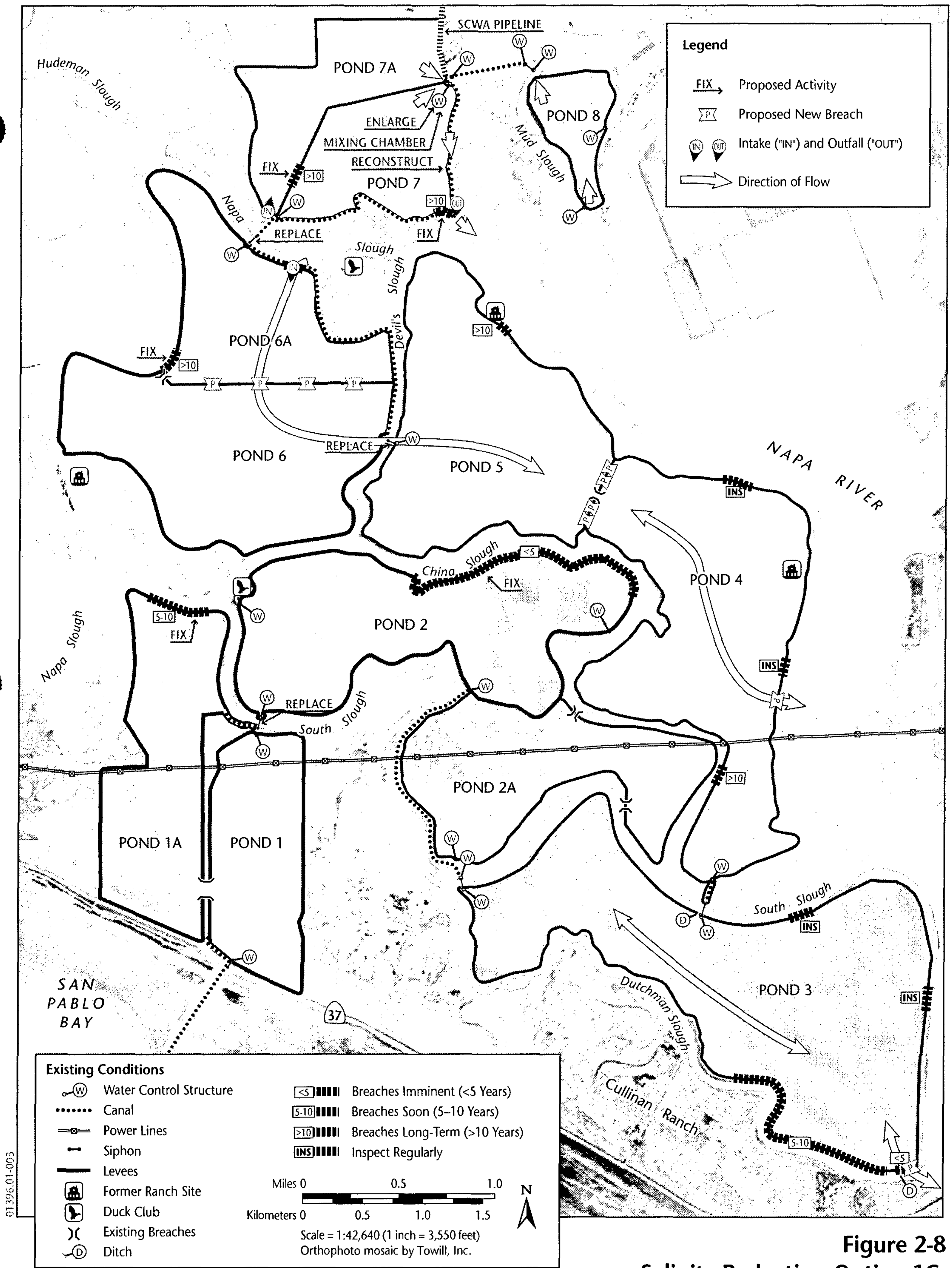


Figure 2-8
Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Jones & Stokes

- Napa Slough to the north-central section of Pond 5 (seven 54-inch diameter intake culverts that bisect the levee and extend approximately 500 feet into the slough); and
- the south-central section of Pond 4 to the Napa River (two 48-inch-diameter outfall culverts bisecting the levees and extending 1,100 feet into the river).

Intakes and Outfalls for Option 1C. Breaches would be built to connect

- the southeast side of Pond 3 to the Napa River (one 50-foot breach serving as both intake and outfall) and
- the south-central section of Pond 4 to the Napa River (one 50-foot breach serving as both intake and outfall for Ponds 4/5).

To ensure effective mixing in Ponds 4/5, the existing Pond 4/5 interior levee breaches would be expanded to four 100-foot-long breaches. In addition, the existing siphon between Ponds 5 and 6 would be refurbished or replaced with a new 250-foot-long, 52-inch-diameter siphon. All culverts for Ponds 3, 4, and 5 would be constructed of a lighter-weight material, most likely a coated corrugated iron. These intakes are only required to last until the ponds are opened to tidal action as part of the habitat restoration effort, most likely no more than 5 years.

All culvert intakes would be equipped with gate valves to prevent water from passing into the sloughs or the Napa River from the gates. These intakes would also be equipped with manual knife valves to allow manual control of the intakes, as needed. If fish screens are required, they would be installed on the river or slough side of the intakes. The size and number of intakes described above is sufficient to compensate for the reduced intake flow effects of any fish screens that may be required.

All culvert outfalls would be equipped with diffusers to enhance mixing/dilution of the discharge. Diffusers would be the same diameter as the outfall, and would vary from 50 to 100 feet in length. Each diffuser would include ten 8- to-10-inch-diameter discharge ports along its length, and one 12- to 16-inch-diameter discharge port at its end. The ports would be fitted with neoprene check valves that open only when the tidal elevation is lower than the pond water elevation. The diffusers would be located close to the Napa River channel and would be marked by appropriate navigation aids.

To reduce impacts on existing habitat and minimize construction costs, the Pond 4/5 culvert outfalls would be located in an area with minimal accreted marsh (Figure 2-6). If necessary to ensure adequate circulation, water could be brought into the southernmost portion of Pond 4 via the siphon between Ponds 3 and 4.

Levee Repairs and Long-Term Levee Maintenance. Levee repairs would not be required for Pond 3 or 4/5, as the ponds would be desalinated prior to any projected potential levee failure.

Equipment. Installation of water control structures around Ponds 3 and 4/5 would require the use of heavy equipment delivered to the site by barge at extreme high tide. Heavy equipment, generally low-pressure, long-reach excavators, would be used to construct the intakes and outfalls. The equipment would have wide tracks and/or use mats to ensure that its weight is evenly supported and that compaction rates on existing habitats would be low.

Approximate types and maximum quantities of equipment that would be used for Option 1A include one or two long-reach excavators, two or three diesel-powered barges, one or two small to medium bulldozers, trucks, a diesel generator, a sheet pile driver, and small boats for daily transportation to and from the site. Breaches would be constructed using explosives.

Construction of Option 1B would require the same equipment as Option 1A, but for only about half the time. The only equipment required for Option 1C is a small bulldozer to dig trenches for explosives and excavate the exterior levee, and the small boats required to transport the explosives crew and their supplies.

Timing and Duration. The required water control structures would be constructed in the late spring and summer to meet construction/species habitat windows, and salinity reduction would begin in the winter or early spring to take advantage of the rainy season (December–March). Construction would require most of the season for Option 1A, and correspondingly less time for Options 1B and 1C. To assess maximum potential impacts, this document assumes that the breaching of Ponds 3 and 4/5 for Option 1C would be conducted simultaneously. ~~It is likely that breaching~~ Breaching of these ponds would be phased to allow for monitoring and adaptive management.

Operations and Maintenance

Operations and maintenance (O&M) for Option 1C would consist simply of monitoring the salinity reduction in newly breached ponds and the salinity of the receiving waters. O&M for Options 1A and 1B is described below.

Facilities. For Options 1A, 1B, and 1C the ponds would be filled with water at the start of the wet season to reduce salinity as much as possible. However, the maximum water height in the ponds would be controlled to remain at least two feet below the levee crest, to avoid further erosion concerns with the levees.

For Options 1A and 1B, i~~I~~ntakes and outfalls would largely be tidally driven but could also be manually closed to reduce flows, if required. Locations of intake and outfall culverts are described above under "Construction."

Under Salinity Reduction Option 1A, to allow maximum dilution of the brine at the point of Pond 3 discharge, the discharge would occur at the deepest portion of the Napa River feasible, as determined by the engineers. Because the Napa River is wide and shallow in the project area (there are large tidal flats at low tide), the discharge location should be immediately adjacent to the Napa River deepwater channel (if that location meets navigation constraints), approximately 1,100 feet from the Pond 3 levee.

For Options 1B and 1C, appropriate breach locations on the levees would be identified before the wet season and set up for breaching during the high flow event. Explosives would be set and the breaches created as soon as it has been determined that a major storm event is in progress.

Levees would be breached at the southeast corner of Pond 3 for Option 1B (Figure 2-7), and, for Option 1C, on the east side of Pond 4 as well (Figure 2-8). Any additional breaches required to facilitate habitat restoration would be created after pond desalination has been completed. Each breach would be approximately 50 feet wide. The proposed breach locations correspond to the mouths of major historical sloughs as feasible.

Timing and Duration. Based on current modeling results and assumed initial conditions, operations associated with Ponds 3 and 4/5 could proceed on the following schedule beginning in approximately September 20054.

- **Pond 3 (Option 1A only):**

Salinity reduction would require approximately 6 months. Following construction of habitat restoration features, Pond 3 would be opened to tidal action with the breaching of one or more levees at the location of the water control structures. Breaching of the levees is considered part of the habitat restoration options (see Section 2.5.4, "Habitat Restoration Options"). [Note: Pond 3 is retained throughout the analysis as a reference point, though the site has evolved to background salinity conditions.]

- **Pond 3 Only (Option 1B only):** The typical 2-year high flow event is sufficient to allow breaching of Pond 3 following construction of habitat restoration features. Option 1B would result in a maximum average salinity increase of 7 ppt in the Napa River. Within 48 hours, that maximum increase would have dropped to 4 ppt, and within 4–5 days, the difference would be approximately 2 ppt (i.e., the same as for discharge via outfalls), well below the target threshold of 5 ppt. After approximately 1 month, there is no further discernable influence on the ambient salinity in the Napa River. It should be noted that the salinity increase is relative to the Napa River baseline, which drops to near 0 ppt during a high flow event. It is very likely that the salinity "spike" would at most bring the ambient salinity back to the same level that it was before the high flow event.

- **Pond 4/5 (Options 1A and 1B):**

Salinity reduction would require approximately 12–18 months. This process would begin simultaneously with desalination at Pond 3. Once Pond 4/5 is desalinated, it would serve as a mixing chamber during desalination of Pond 6/6A. During this time, Pond 4/5 may be opened to muted tidal action by simply keeping all water control structures open.

- **Ponds 3 and 4/5 (Option 1C only):** Because Pond 4/5 has a higher salinity than Pond 3, breaching both Ponds 3 and 4 following construction of habitat restoration features would result in a higher salinity spike during the same 2-year high flow event. The maximum estimated increase in ambient salinity would

occur within 24 hours, and is estimated to be 17 ppt over ambient levels. As with Option 1B, it should be noted that this spike is relative to the drop in salinity resulting from the high flow event. Salinities less than a week prior to the high flow event could easily be higher than the salinity after Ponds 3 and 4 are breached. The salinity spike begins to dissipate rapidly, dropping to a daily maximum differential of approximately 10 ppt within 48 hours, a daily maximum differential of approximately 6 ppt within 1 week, and to less than 4 ppt within 2 weeks. After approximately 2 months, there is no measurable increase in ambient salinity. In other words, the ambient salinity differential would be at or below the target threshold within approximately 1 week. One week is considered to be the minimum amount of time that would be required to repair an accidental levee breach.

Thus, depending on the desalination option selected, Pond 3 would be available for habitat restoration 1–6 months after the start of desalination, and Pond 4/5 would be available for habitat restoration 2 months–3 years after the start of desalination.

Ponds 6/6A, 7, 7A, and 8

Construction

Facilities. New water intakes and water control discharge locations (outfalls) would be required so that an effective water circulation pattern could be established. The anticipated intake and outfall locations for each of the ponds are shown in Figures 2-6 through 2-8. As noted earlier, facilities at and operation of Ponds 6/6A, 7, 7A, and 8 are the same for Salinity Reduction Options 1A–1C.

Intakes and outfalls would be constructed at locations that would minimize effects on existing marsh habitat and minimize the length of pipes needed (because they would take advantage of deeper slough channels close to the levee). Interior levees would be breached using explosives where applicable. Levee repairs would also be required.

Intakes. New intake culverts would be built to connect

- Napa Slough to the north-central section of Pond 6A (five 52-inch-diameter culverts that bisect the levee and extend approximately 250 feet into the slough);
- the Pond 7/7A canal to Pond 6A and the Pond 6/6A canal (one 52-inch-diameter, 350-foot-long siphon under Napa Slough);
- Napa Slough to the south side of Pond 7A (an 800-foot intake canal linked to culverts that bisect the levee); and
- the recycled-water pipeline to Pond 7.

A new intake consisting of two 30-inch-diameter culverts with gates and fish screens has already been constructed for Pond 8. The culverts are made of HDPE. The existing donut on the northeast side of Ponds 7 and 7A would be

~~replaced with~~ converted to a mixing chamber, with the appropriate inlets and outlets to control flows into and out of the mixing chamber. Intakes, outfalls, and siphons for Ponds 6/6A, 7, 7A, and 8 would be constructed of HDPE; valves would be made of stainless steel.

All intakes would be equipped with gate valves to prevent water from passing into the sloughs or the Napa River from the ponds. The intakes would also be equipped with manual knife valves to allow manual control of the intakes, as needed. If fish screens are required, they would be installed on the river or slough side of the intakes. It should be noted that the size and number of intakes describes above is sufficient to compensate for the effects of any fish screens that may be required.

To ensure effective mixing in Ponds 6/6A, the existing 6/6A interior levee breaches would be expanded to four 100-foot-long breaches.

Outfalls. New outfall culverts would be built to allow water to flow from the southern portion of the canal adjacent to Pond 7 to Napa Slough (one 42-inch diameter culvert extending 300 feet into the slough).

The outfalls for the upper ponds and the replacement siphons would be constructed of HDPE to ensure a long operating life. The outfalls would be equipped with diffusers to enhance mixing/dilution of the discharge. Diffusers would be the same diameter as the outfall, and would vary from 50 to 100 feet in length. Each diffuser would include ten 8- to-10-inch-diameter discharge ports along its length, and one 12- to 16-inch-diameter discharge port at its end. The ports would be fitted with neoprene check valves that open only when the tidal elevation is lower than the pond water elevation. The diffusers would be located near the deepest portion of the Napa Slough, and would be marked by appropriate navigation aids.

Other Water Control Structures. Improvements would be made to existing donuts on Pond 6 and 6A including replacing existing gates and other donut structures. An overflow weir to Devil's Slough would be added, and a new 48-inch wide, 200-foot long, culvert with a flap gate would be installed from Pond 6 to Napa Slough/Little Island. Two new discharge gates would be built connecting Ponds 7 and 7A to a mixing chamber. The gate at Pond 7 would be built so that a dilution ratio of 5:100, or other approved dilution ratio (1:100), could be achieved at the mixing chamber. New or refurbished water control structures would connect Pond 5 to Pond 6, and Pond 8 to Pond 8 canal, and the Pond 8 canal to the mixing chamber.

Levee Repairs and Long-Term Levee Maintenance. Initial levee repairs would be required for Ponds 1, 1A, 2, 6/6A, 7, 7A, and 8 to reinforce areas that could fail in the near future (within 5–15 years). Desalination of Ponds 7, 7A, and 8 may not be completed before these levees would fail. Initial levee repairs are also required at Ponds 1, 1A, and 2, if these ponds are to be maintained as ponds in the long term. If Ponds 6/6A are to be adaptively managed, levee repairs are required to ensure that the levees retain their integrity during the adaptive management period (10–20 years). An estimated total of 2 miles of levee would

require initial repairs; the levee on Pond 2 would require two rounds of material placement because it is so deteriorated (Huffman pers. comm.). The material deposited in the first round would have to settle and achieve sufficient stability from drying before the second layer of sediment could be placed. The second round of material would then be used to fill, compact, and dress the levee for future access.

Long-term levee maintenance for Salinity Reduction Option 1 would consist solely of levee maintenance at Ponds 7, 7A, and 8. Salinity reduction for the upper ponds is expected to require ~~30~~ 6 to 8 years if recycled water is used to aid in desalination (see Section 2.5.3.1). Desalination for Ponds 7A and 8 is expected to be completed in 1–3 years. Without the use of recycled water, desalination of Pond 7 could require an additional ~~10–20~~ 2 to 3 years. Approximately 5% of the length of these levees is expected to require repairs each year.

Levee repair and long-term maintenance would require the same types of activities. Soil would be added to the existing levees either through importing material or excavating soil from the internal borrow ditch in each of the ponds. In general, most of this work could be done from the levee itself. Ponds 1, 1A, 7, 7A, and 8 are all accessible by land and imported material could be used. However, the cost would be high, and it is likely that the material used to repair the levees at these ponds would also be excavated from the borrow ditch. Ponds 2 and 6/6A would use borrow ditch material because barges would be unable to carry material to Pond 2 or Pond 6/6A.

Material to reinforce the levees would be excavated from the existing borrow ditches using a long-reach excavator. The excavated material would be placed at the sides and tops of the levees, with specific locations, soil heights, and slopes to be determined by a geotechnical engineer. As it completes repairs, the excavator would move forward along the top of the levee. The excavator could also work from a barge if needed; however, obtaining access to the levees by barge would be difficult in many locations because of the accreted outboard marsh. Limited dredging may be required to allow access for the barges associated with the levee repair work, as well as for the barges delivering materials and equipment to install the water conveyance structures.

Equipment. Repair of levees and installation of water control structures at Ponds 1, 1A, 2, 6/6A, 7, 7A, and 8 would require the use of heavy equipment delivered to the site by road or barge (SR 37 for Ponds 1, 1A, and 2; Buchli Station Road for Ponds 7 and 7A; SR 12/121 via Duhig Road, Las Amigas Road, Cuttings Wharf Road, and Milton Road for Pond 8; and via barge at high tide for Ponds 2 and 6/6A).

Heavy equipment, generally low-pressure, long-reach excavators, would be used to construct the intakes and outfalls. The excavators would need to have a reach of at least 40 feet to complete work at Pond 2. They would have wide tracks and/or use mats to ensure that their weight is evenly supported and that compaction rates on existing habitats would be low. The excavators would be brought to the needed location for Ponds 1, 1A, 7, 7A, and 8 on trucks, and to Ponds 2 and 6/6A on barges that can travel at extreme high tides. Approximate

types and maximum quantities of equipment that would be used for the project sites include one or two long-reach excavators, two or three diesel-powered barges, one or two small to medium bulldozers, five or six land-based dump trucks, a small clamshell dredge, a diesel generator, a sheet pile driver, and small boats for daily transportation to and from the site.

Timing and Duration. The required water control structures would be constructed in the late spring and summer to meet construction/species habitat windows, and salinity reduction would begin in the winter or early spring to take advantage of the rainy season (December–March).

Operations and Maintenance

Facilities. Intakes and outfalls would largely be tidally driven but could also be manually closed to reduce flows, if required. Locations of intake and outfall culverts are described above under "Construction."

For Options 1A and 1B, the discharge for Pond 6/6A would be to Pond 4/5 via the siphon between Ponds 5 and 6. Pond 4/5 would act as a mixing pond for discharge from Pond 6/6A, and the ultimate discharge would continue to be the outfall at the southeastern side of Pond 4. Currently the salinities in Pond 6/6A are low, and the project sponsors may allow water to flow from Pond 6/6A into Pond 5, providing additional dilution water into Pond 4/5. Flow through the siphon between Ponds 5 and 6 would be controlled to ensure that the salinity in Pond 4/5 remains at an acceptable level.

For Option 1C, discharge from Pond 6/6A would also be to Pond 4/5; however, Pond 4/5 would be open to tidal action as a result of the breach. Modeling for Salinity Reduction Option 1A has shown releasing water from Pond 6/6A to the Napa River via Pond 4 results in only a minor increase in ambient salinity (typically less than 2 ppt). Thus, releasing Pond 6/6A water into Pond 4/5 under Option 1C does not pose a concern for receiving waters in the ponds. Releasing Pond 6/6A water to Pond 4/5 under Option 1C is also unlikely to cause a substantial salinity increase in the Napa River, because Pond 6/6A salinities are much lower than Pond 4/5 salinities (Pond 6/6A salinities are closer to Pond 3 salinities). Once Pond 6/6A is largely desalinated, breaches may be made from Pond 5 to Napa Slough. This would improve circulation of the water in this area.

While each of the lower ponds would be desalinated in series, the upper ponds are linked for desalination. The upper ponds present special challenges in desalination because Pond 7 is the bittern pond~~, and Pond 8 contains high salinity brine and also has a low pH~~. Toxicity studies completed by Cargill (S.R. Hansen and Associates 1993) indicate that bittern is toxic to aquatic organisms at concentrations exceeding 1%. Thus, as a conservative assumption, bittern in its current state must be diluted 100:1 before discharge or diluted using other high salinity brine to provide an improved anion/cation balance. Chronic aquatic toxicity tests (7-day) were conducted in 2002 to determine possible discharge levels (Pacific EcoRisk 2002) and suggest that higher discharge rates (up to 5%) may be feasible. ~~In addition, it may be necessary to raise the pH in Pond 8 prior to discharging from this pond at high rates.~~

Discharges from Ponds 7, 7A, and 8 would be combined in a mixing chamber before discharge into Napa Slough. Discharge from Pond 7 would be controlled so that its flow is 1%–5%, depending on the discharge permit, of the total flow ~~entering~~ from the mixing chamber. (The design of the mixing chamber would also allow the addition of recycled water, if recycled water use is incorporated into the complete alternative.) If recycled water is added, the discharge from Pond 7 ~~all of the upper ponds~~ could increase. The discharge from Pond 7 would increase by a rate equivalent to 1%–5% of the recycled water, depending on the discharge permit. ~~The increase in discharge from Ponds 7A and 8 would depend on the salinity of the ponds. Given the relatively small volumes of brine in Ponds 7A and 8, however, the increased dilution provided by the recycled water would not have a substantial effect on the time required to desalinate these ponds.~~ The use of recycled water is described in Section 2.5.3, "Water Delivery Option."

Pond 8 would convey water into the canal passing to the northeast of Mud Slough (Figure 2-8). Pond 8 would operate based on water level also (hydraulic head) only. Flow rates from Pond 7A into the mixing chamber would be determined by the hydraulic head present in the ponds and the mixing chamber. The control gates from Ponds 7A and 8 into the mixing chamber ~~would~~ could also be used to regulate inflows, if specific (reduced) flow rates are desirable ~~and would depend on the relative pond salinities~~. Water from the mixing chamber would be sent through the canal east of Pond 7 ~~canal~~ to discharge into the Napa Slough. After initial salinities have decreased ~~(after 1–2 years)~~, the discharge from the mixing chamber could be increased with the same rate of discharge to Napa Slough~~, and additional discharge either into Pond 6A or into the canal adjacent to Ponds 6/6A and from there into Pond 5~~. ~~This approach could potentially double the rate of bittern discharge, and reduce the time required to desalinate Pond 7 by 15–25 years.~~

~~The estimated discharge from Ponds 7, 7A, and 8, via the mixing chamber and the reconstructed canal is 7 cfs (RMS); this could potentially double to 14 cfs (RMS) once discharge through the siphon under Napa Slough is added.~~

Timing and Duration. Based on current modeling results and assumed initial conditions, operations could proceed on the following schedule beginning in approximately September 20064.

- Pond 6/6A:
  - Salinity reduction would require approximately 12–18 months. This process would begin once Pond 4/5 has reached ambient salinities, i.e., either 1–2 months after the start of desalination under Option 1C or 12–18 months after the start of desalination under Options 1A and 1B.
  - Breaching of Pond 6/6A may occur many years after it has reached ambient or near-ambient salinity as described in Section 2.5.4, "Habitat Restoration Options," if at all. The future management of Pond 6/6A depends on the habitat restoration option selected.

- Ponds 7, 7A, and 8:
  - Pond 7A has relatively low salinity ~~and of the three ponds is expected to reach ambient salinity levels first~~; the estimated time for Pond 7A to reach ambient salinity levels is 1–2 years.
  - Pond 8 salinities have ~~also~~ decreased to ambient levels~~; however, Pond 8 has a low pH and may require adjustment of the pH prior to desalination~~.
  - Pond 7 contains high-salinity bittern. Salinity reduction in Pond 7 is estimated to require 8 – 10~~30–50~~ years. The duration required to desalinate Pond 7 is much greater than that for the rest of the ponds because the bittern requires such high dilution prior to discharge. Decreasing the required pre-dilution ratio for bittern would reduce the time required for salinity reduction in this pond.

The estimated time for Pond 7 bittern removal has decreased substantially since the release of the Draft EIR/EIS. According to studies conducted prior to the Draft EIR/EIS and Draft Feasibility Report, bittern removal and salinity reduction would take approximately 30 years with recycled water, and approximately 50 years using exclusively Napa River and Napa Slough inputs ("neighboring waters"). The new analysis estimates that it would take approximately 8 – 10 years using neighboring waters, and a slightly shorter period of time using additional recycled water (Corps' Feasibility Report, Appendix D, Engineering Appendix). The change in estimated time results from using a mass-based rather than a flow-based discharged restriction.

Based on toxicity studies, the regulatory agencies have indicated that bittern discharge from Pond 7 must be limited to 1% of the total flow from the Upper Ponds. While this restriction implies a certain mass removal (based on the Year 1 bittern concentration and flow), in earlier iterations of the Corps' Draft Feasibility Report, this flow-based discharge restriction was assumed to apply throughout the life of the project. This flow-based approach resulted in very long time periods before bittern would be reduced sufficiently to create habitat value in Pond 7. Bittern removal using a flow-based discharge restriction requires a long time because as the bittern concentration in the pond drops, less and less bittern is removed each year.

Assuming that a constant mass of bittern (i.e., under a mass-based discharge restriction) can be removed each year means that the allowable flow discharged from Pond 7 can increase as the concentration of bittern in the pond decreases, resulting in a shorter restoration period than previously expected.

2.5.2.2 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Introduction

As noted earlier, numerous reverse flow options were considered but eliminated because they would increase desalination time (delay the time at which one or more ponds could be opened to tidal action) and/or could lead to unacceptably high increases in salinity in the lower ponds, which are already viable habitat. However, reverse flow would allow discharge to San Pablo Bay, which could increase the San Francisco Bay RWQCB's allowable discharge rate for salt (because San Pablo Bay is more saline than the Napa River, has a larger tidal flow, and has much better mixing and dispersion).

This modified reverse-flow option addresses the issue of delay in opening the ponds, as well as controlling the salinity increases in the lower ponds, while still allowing discharge to San Pablo Bay. Under this option, there would be two components: salinity reduction in Ponds 3, 4, and 5, with discharge to the Napa River; and salinity reduction in Ponds 7, 7A, and 8 via Ponds 1, 1A, 2, and 6/6A, with discharge to San Pablo Bay. Although salinity reduction is not required for Ponds 1, 1A, and 2, water would be discharged to San Pablo Bay in part through the existing culvert at Pond 1; therefore, this component includes transfer of higher salinity water (including diluted bittern) through Ponds 1, 1A, and 2, which are already managed tidal ponds.

The salinity reduction process for these two components would occur simultaneously as described below and illustrated in Figure 2-9.

Ponds 3 and 4/5

Construction

Facilities. Construction would be very similar to that described for Ponds 3 and 4/5 under Salinity Reduction Option 1A. As for Salinity Reduction Option 1A, the two ditches in the Pond 3 levees would have to be filled in. Under Salinity Reduction Option 2, Pond 3 would not be opened to tidal action immediately after it reaches ambient salinity, but instead would act as a mixing chamber for the desalination of Pond 4/5. This means that no outfall would have to be built from Pond 4 to the Napa River.

The locations of the intakes and outfalls are shown in Figure 2-9. Pond 3 intake and outfall locations are identical to those described for Salinity Reduction Option 1A. The intake at Pond 5 for desalination of Pond 4/5 is also the same as for Salinity Reduction Option 1A; however, the discharge would be via the outfall at the southeast corner of Pond 3. In addition, as noted above, the existing levee breaches between Ponds 4 and 5 would be widened so that there would be four 100-foot-long breaches. A manual control structure would be installed at the siphon between Ponds 3 and 4 (the structure would be closed if the Pond 3 discharge exceeds the permit requirements). The number and sizes of intakes

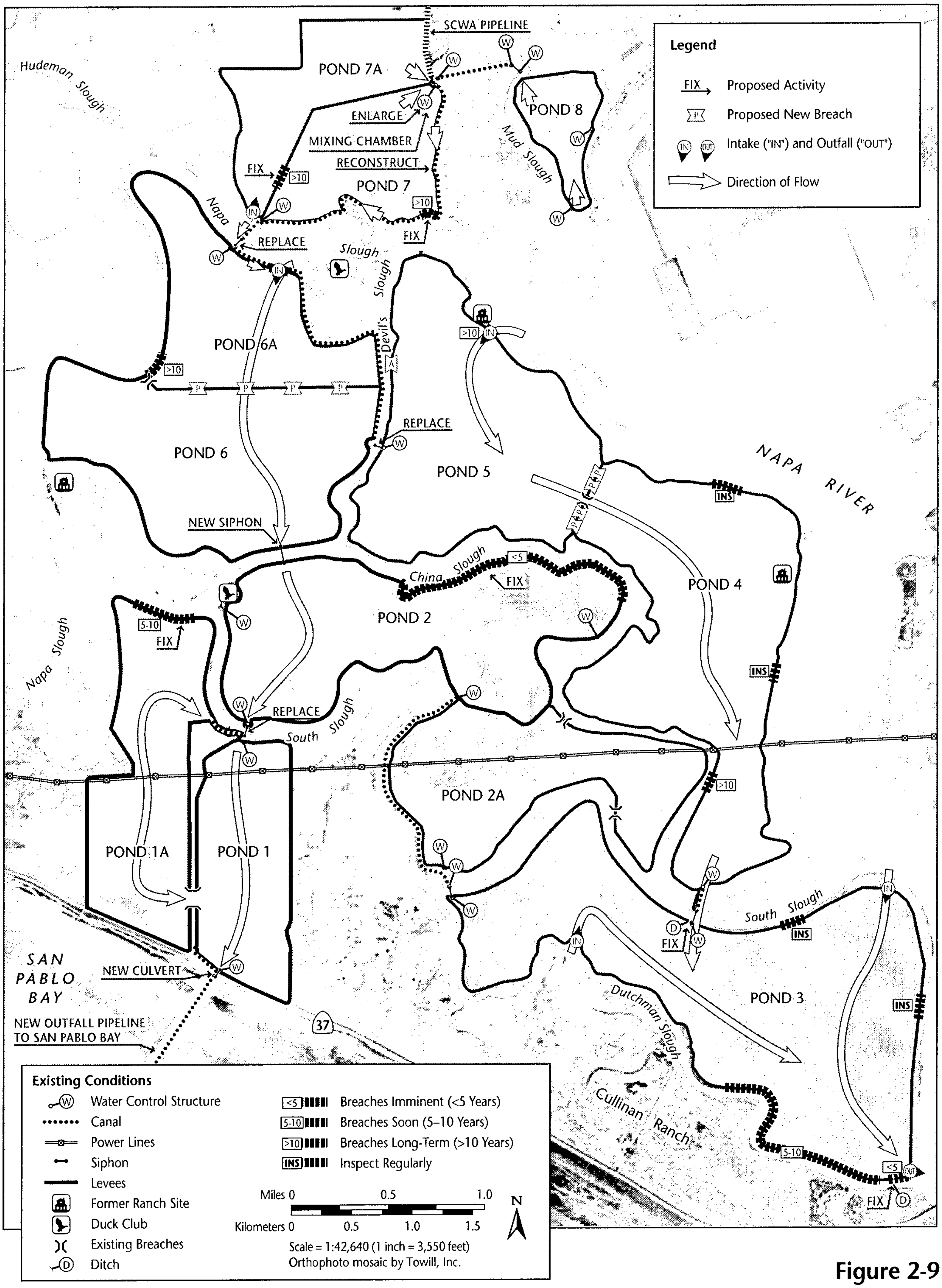


Figure 2-9
Salinity Reduction Option 2:
Napa River and San Pablo Bay Discharge

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and outfalls would be different than for Salinity Reduction Option 1A, because there would be no discharge from Ponds 6/6A. This option would include the water conveyance structures for Ponds 3 and 4/5 listed below.

Intakes. Intakes would be constructed to connect

- the Napa River to the northeast corner of Pond 3 (nine 54-inch culverts that bisect the levee and extend approximately 600 feet into the river);
- Dutchman Slough to the southwestern side of Pond 3 (three 48-inch-diameter culverts that bisect the levee and extend approximately 300 feet into the slough);
- Napa Slough to the north-central section of Pond 5 (eleven 54-inch-diameter culverts that bisect the levee and extend approximately 500 feet into the slough); and
- Pond 4 to Pond 3 (one 48-inch-diameter, 350-foot-long siphon under ~~Napa~~ South Slough).

Outfalls. Outfalls would be constructed to connect the southeast side of Pond 3 to the Napa River (two 52-inch diameter culverts bisecting the levees and extending 1,100 feet into the river).

Equipment. Equipment used for construction would be the same as under Salinity Reduction Option 1A.

Timing and Duration. Timing of construction would be the same as under Salinity Reduction Option 1A.

Operations and Maintenance

Facilities. Salinity reduction operations for Ponds 3 and 4/5 would be very similar to the operations for these ponds under Salinity Reduction Option 1A. However, as described above, after it reaches ambient salinity Pond 3 would act as a mixing chamber for the desalination of Pond 4/5. Widening the breaches of the levee between Ponds 4 and 5 would promote mixing between the ponds. The water from Pond 4/5 would be transferred southward under South Slough to Pond 3 through the siphon between Ponds 3 and 4, before being discharged into the Napa River. Flow through the Pond 3/Pond 4 siphon would be controlled to ensure that the salinity in Pond 3 remains at an acceptable level. Operation and monitoring of the intakes and outfalls would be identical to that described for Pond 3 intakes and outfalls in Salinity Reduction Option 1A.

- ~~Operation and monitoring of the intakes and outfalls would be identical to that described for Pond 3 intakes and outfalls in Salinity Reduction Option 1A.~~

Timing and Duration. As under Salinity Reduction Option 1A, operations would begin in approximately September 20045. The levee breach and ditch on Pond 3 would first have to be repaired. Because Pond 3 would act as a mixing chamber for Pond 4/5 desalination, habitat restoration could not begin there until

the desalination of Pond 4/5 is complete. Ponds 3 and 4/5 could be opened to tidal action approximately 2–3 years after the start of the desalination process. However, to avoid adverse impacts associated with the increased tidal prism, it is likely that ponds would have to be opened to tidal action sequentially; therefore, Pond 4/5 probably could not be opened to tidal action until several years after it is desalinated.

Ponds 1, 1A, 2, 6/6A, 7, 7A, and 8

Construction

Facilities. The intakes at Ponds 7, 7A, and 8 would be similar to those under Salinity Reduction Option 1, although the outfall into Napa Slough would not be constructed, and no intakes would be required for Ponds 6/6A. Additional infrastructure for this option includes

- installation of two 54-inch siphons from Pond 6 to Pond 2;
- replacement of an existing 72-inch siphon that connects Pond 2 to Ponds 1 and 1A with two 54-inch siphons, or refurbishing the existing siphon; and
- construction of one new 63-inch–inner diameter (72-inch–outer diameter) outfall culvert underneath SR 37, allowing water to flow from Pond 1 to San Pablo Bay. The second culvert would be installed to increase the dilution capacity in Ponds 1 and 1A, and thereby increase the rate at which water can be discharged from the upper ponds.

As with Salinity Option 1, the interior levee for Pond 6/6A would have four 100-foot breaches to ensure proper mixing.

Equipment. Equipment used for construction would be the same as under Salinity Reduction Option 1.

Timing and Duration. The increased construction required by this salinity reduction option would either require additional staff and equipment, or would require an additional 2 months to complete compared to the construction effort under Salinity Reduction Option 1.

Operations and Maintenance

Facilities. Salinity in the upper ponds (Ponds 7, 7A, and 8) and Pond 6/6A would be reduced through mixing and discharge via Ponds 1, 1A, and 2. As shown in Figure 2-9, additional water from Napa Slough would be introduced into the upper ponds and conveyed southward through Ponds 6A, 6, 2, and 1/1A, in that order, before being discharged into San Pablo Bay.

Discharge from the upper ponds would follow the same general approach as under Salinity Reduction Option 1. Ponds 7, 7A, and 8 would discharge to a mixing chamber. As with Salinity Reduction Option 1, recycled water could be introduced into the mixing chamber to provide added dilution. The use of recycled water is described in Section 2.5.3, "Water Delivery Option." From the

mixing chamber, the water would be conveyed through the siphon under Napa Slough into Pond 6/6A.

In general, flow from the upper ponds would be controlled by measuring the salinity of the water leaving Pond 6/6A. The siphon under Napa Slough would be equipped with a water control structure that would close if the salinity at the Pond 6/6A discharge location exceeds a preset value. The closing of the siphon under Napa Slough would in turn trigger closure of the mixing chamber discharge. The increased water height (head) in the mixing chamber would then prevent more water from the ponds from entering the mixing chamber. The flow from Pond 7 into the mixing chamber would be controlled at a ratio that considers the flow from Ponds 7A and 8, as well as the added dilution water provided in Ponds 1 and 1A.

From Pond 6/6A, the water would pass through a new siphon to Pond 2, and from there through the refurbished siphon or replacement siphons into Ponds 1A and 1. Ponds 1 and 1A would be used as a mixing chamber for the water conveyed from Pond 2. From Ponds 1 and 1A the water would be discharged into San Pablo Bay through the two outfall culverts under SR 37.

The capacity of the intakes for Ponds ~~7 and~~ 7A would be double that of Salinity Reduction Option 1. The outfalls (discharges to the mixing chamber) would allow 2.5 times the flow of Salinity Reduction Option 1. As with Salinity Reduction Option 1, the bittern would have to be diluted by a factor between 1:100 and 5:100 before discharge. The higher overall water flow through the system (including the dilution water brought into Ponds 1 and 1A) means that the total discharge from Pond 7 would be approximately 2.5 times higher than for Salinity Reduction Option 1.

Timing and Duration. As under Salinity Reduction Option 1, operations would begin in approximately September 20046. Salinity reduction would proceed as follows:

- **Ponds 1, 1A, 2, and 6/6A:** Because higher salinity water would be mixed with the water in these ponds, salinity would increase temporarily during the desalination period. The increase in salinity would peak at approximately 20–30 ppt over existing salinities for Ponds 1, 1A,and 2; the Pond 6/6A salinity would not increase above the starting salinity. Salinity in Ponds 1, 1A, and 2 would begin to decrease as the salinities in the upper ponds begin to decrease.
- **Ponds 7, 7A, and 8:** Flushing the bittern pond (Pond 7) ~~is estimated to be reduced~~ to ambient conditions is estimated to require ~~in~~ less than 10 years.~~; it may require up to 15 years if recycled water is not employed.~~ Ponds 7A ~~and 8 have~~ has a much lower ~~salinities~~ salinity than Pond 7; coupled with the much greater discharge rate from ~~the~~ this ponds, the estimated time required to desalinate Pond 7A ~~both of these ponds~~ under Salinity Reduction Option 2 is 6 months–1 year. If recycled water is used, monitoring would be conducted to ensure that there are no adverse consequences for the existing habitat values in the ponds. ~~Because the recycled water would be introduced~~

~~into the lower ponds (rather than being discharged directly to the Napa Slough), there is a possibility that eutrophication could occur seasonally.~~

~~Due to the higher concentration of bittern released from the mixing chamber, the water from the upper ponds could not be discharged through the Pond 6/6A canal into Pond 5, so the discharge is limited to the amount that would be discharged to San Pablo Bay.~~

2.5.3 Water Delivery Option

In addition to water delivery to the project site by the tidal influence of San Pablo Bay, this option includes the delivery of tertiary–treated recycled water from WWTPs in the north bay region. This option includes a *Water Delivery Project Component* and a *Water Delivery Program Component*:

- *Water Delivery Project Component:* A combined 6,000–7,000 af/year of tertiary-treated recycled water would be provided from three local WWTPs—the Sonoma Valley County Sanitation District (SVCSD) WWTP, the Napa Sanitation District (NSD) WWTP, and the CAC WWTP—for salinity reduction, and subsequently for agricultural irrigation. This component is considered feasible and therefore is currently a part of the Water Delivery Option.
- *Water Delivery Program Component:* Tertiary-treated recycled water from other reclamation plants in the north bay region could be added to the system at some point in the future assuming the Water Delivery Project Component is implemented.

The alignment, construction program, and operational characteristics of each of the two pipelines currently proposed for the Water Delivery Option are described below. In addition, pipeline alignments, construction programs, and operational characteristics are described more generally for the potential future addition of recycled water from other reclamation plants.

The impact analyses in Chapters 3–16 of this document are at a project level for the currently proposed concept (Water Delivery Project Component) and at a program level for the potential future phase(s) (Water Delivery Program Component). If specific proposals are made for such future phases, Sonoma County Water Agency (SCWA) would prepare more detailed information. The potential environmental impacts of those future detailed proposals would then be addressed by SCWA at a project level of analysis through a separate supplemental environmental document. The Corps and ~~Coastal Conservancy~~ DFG would not serve as the lead agencies for future analysis, and the current analysis of the water delivery options must also be certified by SCWA.

2.5.3.1 Water Delivery Project Component

Figure 2-10 shows the alignments proposed for the recycled water conveyance pipelines from the SVCSD, CAC, and NSD WWTPs to the proposed new mixing chamber within the Napa River Unit site. The pipeline proposed to carry tertiary-treated recycled water from the SVCSD WWTP is referred to as the *Sonoma Pipeline*, the tertiary-treated recycled-water pipeline from the NSD WWTP is referred to as the *Napa Pipeline*, and the tertiary-treated recycled-water pipeline from CAC WWTP is referred to as the *CAC Pipeline*. The specific characteristics of each pipeline are described below.

WWTPs will have the ability to store recycled water in the event discharges are stopped. The participating WWTPs all have storage facilities. These ponds are currently used to store water during the summer when the plants have zero-discharge requirements, but the agencies would typically not need to operate in this way after the project is implemented. The plants would have more water available during the winter because of infiltration and inflow into their systems and because other local recipients would use some of the recycled water during the summer.

Water Delivery Project Component (Sonoma Pipeline)

Alignment

The proposed Sonoma Pipeline would carry water from the SVCSD WWTP to the Napa River Unit Project site, as illustrated in Figure 2-10. The pipeline would have the two segments described below.

Segment 1: The first segment of the Sonoma Pipeline would be ~~3.3~~4.2 miles long and consist of two 18-inch pipes constructed of polyvinyl chloride (PVC). One pipe is existing; the other pipe would be added parallel to the existing pipe as part of project component construction. ~~Segment 1 of the pipeline would carry water only from the~~The new segment of pipe would initiate at SVCSD WWTP ~~to the water storage reservoirs~~ and extend 4,600 feet south east near the intersection of the railroad line owned by the Northwestern Pacific Railroad Authority (NWPRA) and Ramal Road.

~~This segment would begin just south of the SVCSD WWTP,~~ In this area the pipeline would travel east near an existing flow-splitting structure. This structure directs flow either to a wet-season discharge into Schell Slough or to a pipeline to convey water to storage reservoirs used during the dry season. The existing pipeline, an 18-inch transmission line (T-1), carries water during the dry season but does not have enough capacity to handle higher wet-season flows (approximately 12 million gallons per day [mgd]).

~~To increase the capacity of the existing pipeline, a pump station would be constructed near the splitting structure, and a~~ The ~~second 18-inch PVC pipeline would be built to parallel the existing T-1 transmission line.~~ This pipeline would travel east from the splitting structure for approximately 3,900 feet, then would

turn southeast and continue approximately 13,300 feet along the NWPRA alignment.

Two portions of this pipeline segment, each less than 100 feet long, would be constructed to cross under a portion of Schell Slough and another unnamed creek.

Segment 2: The second segment of the Sonoma Pipeline would be 3.8 miles long, 36 inches in diameter, and constructed of either PVC or high-density polyethylene (HDPE). This segment of pipeline would operate under pressurized flow conditions and carry water from both the SVCSD WWTP and potential future pipelines from the west (Water Delivery Program Component).

The Segment 2 ~~new~~ pipeline would begin near the terminus of both the T-1 transmission line and the new 18-inch transmission pipeline. A new pump station would be required at this location to provide additional capacity for accommodating the existing SVCSD WWTP peak flows and any future increases in peak flow that may result from the addition of recycled water from other treatment plants in the north bay region. The new pump station would be designed and constructed in a modular fashion so that additional capacity could be provided incrementally. The new pump station would seek to maximize use of the existing reclamation storage basins, conveyance pipelines, and pumping capacity to provide a seamless interaction with the existing system.

From the new pump station, Segment 2 would extend east along the south side of the NWPRA railroad tracks for approximately 3,100 feet to Skaggs Island Road. Depending on localized soil conditions and surface topography, it is anticipated that the pipeline would have a minimum burial depth of 4–6 feet along the entire alignment.

At Skaggs Island Road, the pipeline would cross to the north side of the railroad tracks. The pipeline would continue east along the north side of the railroad for another 2.3 miles until it reaches the access road for Ponds 7 and 7A. At least two additional sections, each less than 100 feet long, would be required through this section to cross streams.

At the access road, the pipeline would cross to the south side of the railroad tracks and continue south along the access road for approximately 4,200 feet to its terminus at the mixing chamber.

Construction Characteristics

As described above, the pipeline would be placed mainly within the railroad right-of-way (ROW); the southernmost segment would be located along the Pond 7 and 7A access road on DFG property, and the northwestern portion would be located in an existing easement through grazed and farmed baylands. It is anticipated that the pipeline would be constructed using primarily open-trench methods: the trench would be approximately 6 feet wide and 8–10 feet deep.

The construction corridor activity zone for trenching and pipeline installation would typically be about 30 feet wide, but could be narrowed to 20 feet for short

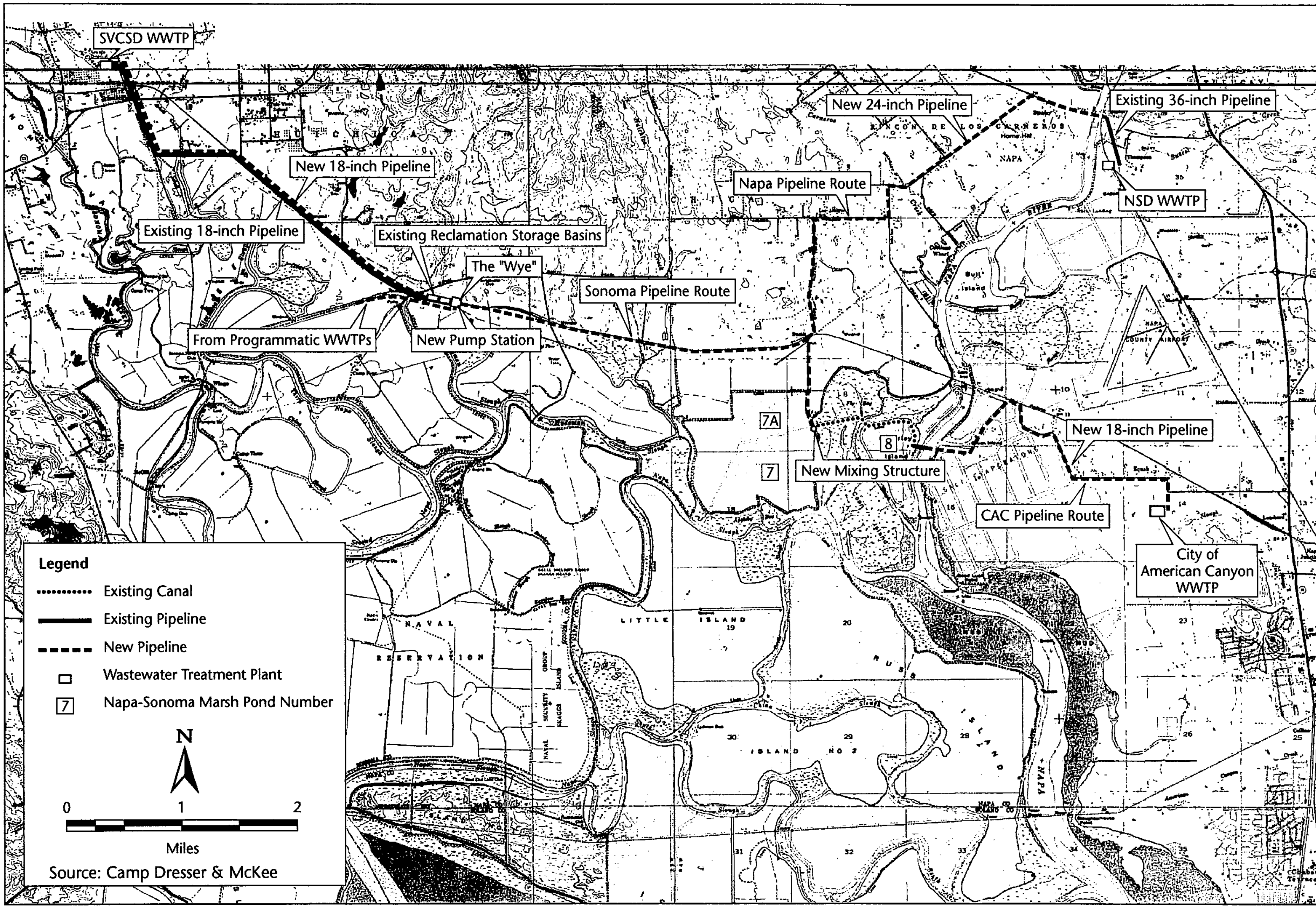

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Figure 2-10
Water Delivery Option: Project Component

distances if necessary (i.e., if there are physical or natural resource constraints). Figure 2-11 provides a cross section of the typical pipeline trench construction area. Traffic control plans would be implemented to maintain traffic flows, including possible use of temporary detours or reconfiguration of travel lanes and turning movements, while the pipeline is installed.

Trenchless construction methods would be used at specific locations along the pipeline route, such as when transitioning the pipeline alignment from one side of the railroad tracks to the other (two such crossings are proposed) and to cross beneath, rather than trench through, streams (at least four such crossings are anticipated).

Construction staging would occur near the proposed pipeline route and include either a single 2-acre staging area centrally located near the route, or two 1-acre staging areas, one near the beginning of the route and the other near the terminus of the route. Staging area location(s) would be selected in conjunction with final design/construction specifications and in coordination with the construction contractor. The staging area(s) would be situated within existing clearings or other disturbed areas.

The typical construction equipment mix for the pipeline construction is likely to include

- a loader/backhoe;
- a small crane;
- six dump trucks, each with a capacity of about 15–18 cubic yards;
- an excavator and/or excavator/compactor;
- a paver and a pavement distributor;
- a roller;
- a water truck;
- a 50-horsepower generator; and
- four pickup trucks for the construction crew.

The contractor's selection of equipment may vary, to some degree, from the above list depending on site conditions, construction needs, and availability of specific pieces of equipment. Only a subset of the above equipment would be in operation or present on-site at any given time, changing at each specific stage of pipeline construction.

It is anticipated that the open-trench pipeline construction method would use 200- to 300-foot-long trench sections and that construction would proceed at an average rate of approximately 50 linear feet of pipeline completed per day. Three work crews would work simultaneously on different sections of the pipeline so that the pipeline could be completed in approximately 1 year, with work days likely to be approximately 10 hours long. Work would typically occur Monday through Friday, beginning between 5 a.m. and 7 a.m. and ending

between 3 p.m. and 5 p.m. The total duration of construction and days/hours of activity could vary from those described above based on weather, field conditions, contractor performance, and special circumstances.

Operational Characteristics

Flows within the pipeline would vary depending on the amount of tertiary-treated wastewater being processed at any given time at the source plant(s). Segment 1 of the pipeline would operate under pressurized flow conditions, and would be designed to convey a maximum wet-weather flow of 12 mgd. Segment 2 would also operate under pressurized flow conditions but would be designed for a maximum peak wet-weather flow of 50 mgd, which would only be experienced under potential future phases (see Section 2.5.~~5~~3.2, "Water Delivery Program Component"). Any peak flows in excess of 50 mgd (e.g., resulting from storm influence) would be attenuated using the existing SVCSD reservoirs.

The pipeline would include a monitoring system to detect any sudden change in pressure (e.g., pipeline break, leak, blockage, or other problem). The system could include a series of pressure gages, spaced along the pipeline or at critical locations, connected to an alarm/autodialer unit or telemetry system that would immediately notify operations personnel of a potential problem.

Water Delivery Project Component (Napa Pipeline)

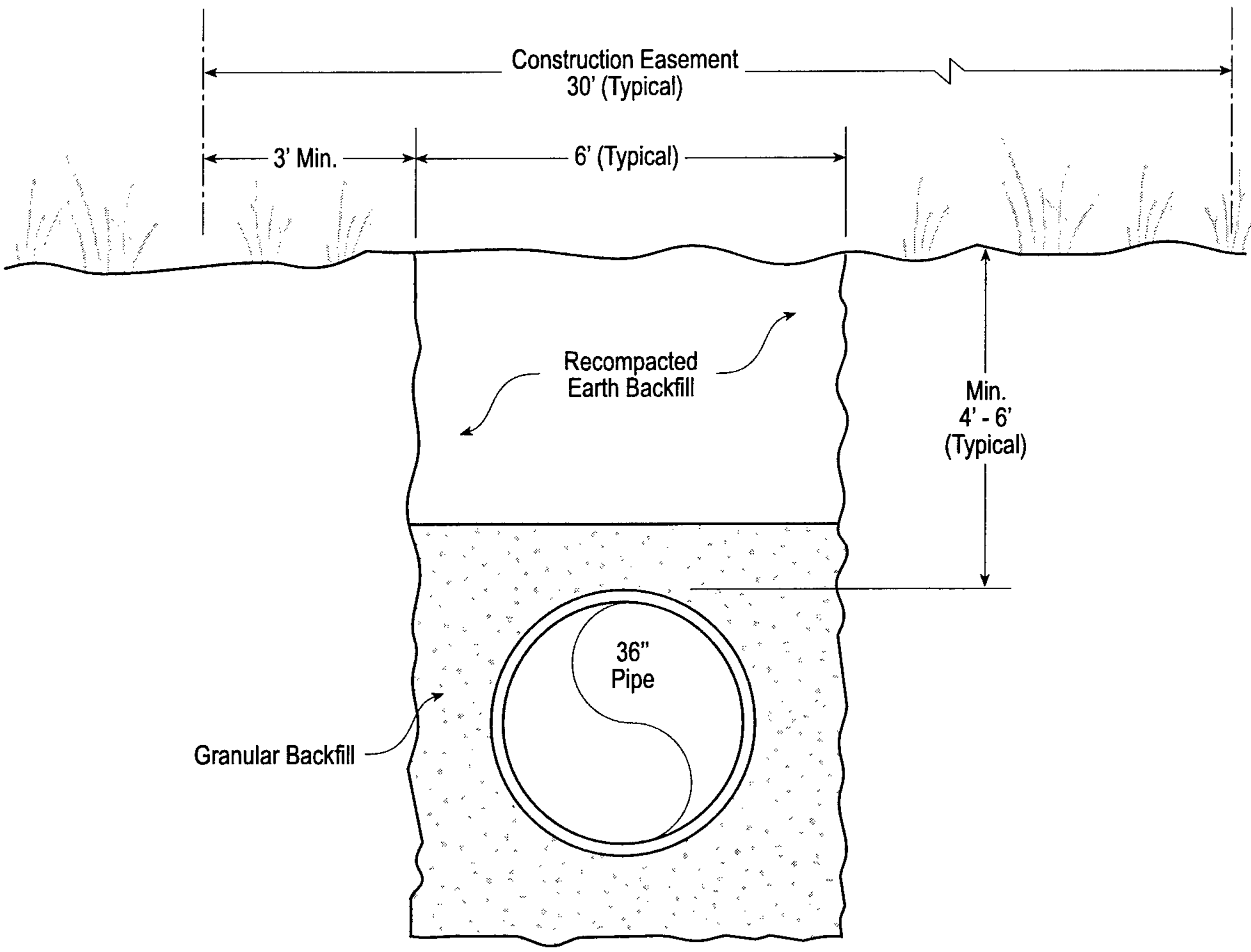
Alignment

In general, the proposed alignment (see Figure 2-10) can be described in terms of the two segments described below.

Segment 1: The first segment of the Napa pipeline would be 3.3 miles long, 24~~"~~ inches in diameter, and constructed of either PVC or HDPE. The pipeline would connect to an existing NSD reclaimed water pipeline that conveys water north to users in the City of Napa. The pipeline would head northwest toward the Los Carneros region and cross under the Napa River using a directional bore process. Once on the western side of the Napa River, the pipeline would proceed northwesterly and connect with Stanly Lane (3,100 feet). The pipeline would continue on Stanly Lane for approximately 1,500 feet until the pipeline turns southwest for approximately 5,000 feet to connect with Cuttings Wharf Road. The pipeline would travel in Cuttings Wharf Road for 3,000 feet and onto Milton Road for 1,700 feet. The pipeline would then turn west on Las Amigas Road for approximately 3,000 feet until it met with Buchli Station Road.

Segment 2: The pipeline would turn south on Buchli Station Road for approximately 5,000 feet and would connect with the Sonoma Pipeline just south of the Northwestern Pacific Railroad Authority rail line. This segment of the pipeline would also be 24~~"~~ inches in diameter and constructed of either PVC or HDPE.

Segment 1 has been analyzed previously in the "Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration." For the purposes of this ~~EIR~~EIS, Segment 2 will be evaluated in all resource categories; Segment 1 will



Source: Camp Dresser & McKee 2002.

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Figure 2-11
Typical Cross Section for Open-Trench Pipeline Construction

be evaluated for resource categories where a change in the existing conditions could change the conclusions of the earlier analysis.

Construction Characteristics

The overall characteristics of the construction program for the Napa Pipeline would be comparable to those of the Sonoma Pipeline described above. The pipeline would be placed mainly within the existing road ROW. A portion of the pipeline (5,000 feet) would also traverse the Stanly Ranch property including crossing an unnamed drainage. Trenching would be used for pipeline construction across the drainage ditch. Approximately 2 acres would likely be required for construction staging at one or two locations along the pipeline route. Staging area locations would be selected in coordination with the construction contractor and are anticipated to be local paved, cleared, or otherwise disturbed lots.

Based on construction methods and a rate similar to those described above for the Sonoma Pipeline, completion of the Napa Pipeline is estimated to take approximately 1 year. Actual construction activity characteristics may vary from those described above based on weather, field conditions, contractor performance, and special circumstances.

Operational Characteristics

The basic operational characteristics of the Napa Pipeline are comparable to those described above for the Sonoma Pipeline, with the most notable exception that the peak wet-weather design capacity of the Napa Pipeline would be only 8.5 mgd rather than 50 mgd.

Water Delivery Project Component (CAC Pipeline)

Alignment

The proposed alignment (see Figure 2-10) is described below in two segments.

Segment 1: The CAC Pipeline would originate at the CAC WWTP. The pipeline would be 18[22] inches in diameter and constructed of PVC. The pipeline would run approximately 2,000 feet north beneath Mezzetta Court through a developed industrial area. The pipeline would intersect with Green Island Road and follow the roadway onto Cargill Salt's property. The length of this segment is approximately 14,000 feet.

Segment 2: This segment of the pipeline would make use of Cargill Salt's existing conveyance pipeline crossing the Napa River. The segment would begin at an existing pumping station on the east side of the river and run directly west through an existing 24-inch transite pipeline to a 16-inch rubber pipeline. The total length of this segment is approximately 2,500 feet. Once the treated water reaches the west side of the Napa River, it could ~~easily~~ be conveyed to the surrounding salt ponds using existing surface waterways within the salt pond complex.

Construction Characteristics

The overall characteristics of the construction program for the CAC Pipeline would be comparable to those of the Sonoma Pipeline described above. The pipeline would be placed mainly within existing roadway and railroad alignments. Approximately 2 acres would likely be required for construction staging at one or two locations along the pipeline route. Staging area locations would be selected in coordination with the construction contractor and are anticipated to be local paved, cleared, or otherwise disturbed lots.

Based on construction methods and a rate similar to those described above for the Sonoma Pipeline, completion of the CAC Pipeline is estimated to take approximately 1 year.

Operational Characteristics

The basic operational characteristics of the CAC Pipeline are comparable to those described above for the Sonoma Pipeline. Similar to the Napa and Sonoma Pipelines described above, the CAC pipeline would convey increased flows during the wet season, when more reclaimed wastewater would be available. The only difference is that the peak winter flows would be 2.5 mgd instead of 8.5 mgd for the Napa Pipeline and 50 mgd for the Sonoma Pipeline.

2.5.3.2 Water Delivery Program Component

If the proposed concept described above is implemented, adding tertiary recycled water from other WWTPs in the north bay region is a reasonable possibility. As the use of tertiary-treated recycled water for salinity reduction and/or agricultural irrigation proves to be a feasible and desirable means of treatment plant water management, and as conveyance pipelines are extended within the north bay region, thereby reducing the incremental amount of new pipeline that each water/sanitation district would need to construct, there would be greater impetus for the other districts to participate. There is considerable uncertainty about the exact nature, extent, and timing of such participation by other water/sanitation districts in the north bay region; however, basic assumptions can be made regarding potential pipeline alignments. As noted above, more detailed project data and attendant project-level environmental analysis would be completed if and when such future proposals were to proceed.

There are three WWTPs in the north bay region that could provide additional tertiary-treated recycled water in a potential future phase of the Water Delivery Option. The following describes and Figure 2-12 illustrates the location of, and potential pipeline route for, each WWTP.

- *Novato Pipeline:* The Novato Sanitary District (Novato SD) WWTP is approximately 14 miles southwest of the project site. A potential pipeline route for conveying tertiary-treated recycled water would start at the plant, proceed northeast along SR 37 for approximately 7 miles to SR 121, then follow an existing railroad ROW for approximately 4 miles, then extend eastward along a small unpaved road for approximately 2 miles, and finally connect with the Sonoma Pipeline.

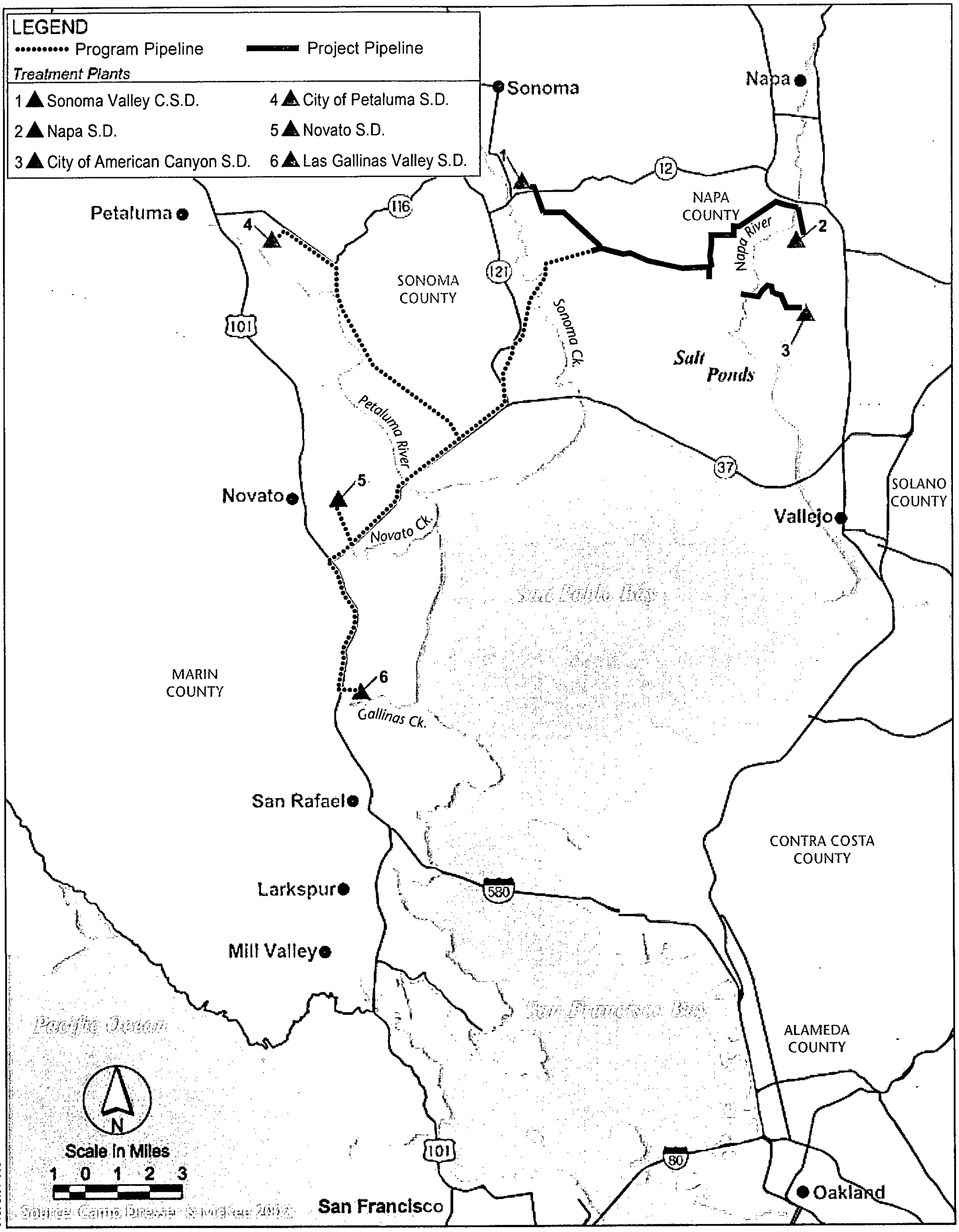

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Figure 2-12
Water Delivery Option: Program Component

- *Petaluma Pipeline:* The City of Petaluma WWTP is approximately 14 miles west of the project site. A potential pipeline route for conveying tertiary recycled water would start at the plant, proceed southeast along Lakeville Road for approximately 10 miles, and then connect with the Novato SD WWTP pipeline.

- *Las Gallinas Pipeline:* The Las Gallinas Valley Sanitary District (LGVSD) WWTP is approximately 17 miles southwest of the project site. A potential pipeline route for conveying tertiary-treated recycled water would start at the plant and proceed north along U.S. Highway 101 (U.S. 101) for approximately 4 miles, and then connect with the Novato SD WWTP pipeline.

It is anticipated that the construction methods, equipment mix, and average work crew size for each pipeline would be generally comparable to those described above for the Water Delivery Project Component. The specifics of the construction activity and the exact alignment of the pipeline route would be determined during the more detailed engineering and design phases. Although this document covers these activities on a programmatic level, future environmental documentation would be required.

2.5.4 Habitat Restoration Options

2.5.4.1 Introduction

This introduction provides an overview of the two types of habitats, tidal marsh and managed ponds, that would be created at the project site, and how these habitats would be created. Tidal marsh is discussed first, followed by managed ponds.

Overview of Tidal Marsh and Tidal Wetland Restoration

Overview of Tidal Marsh

Tidal marsh is vegetated wetland that is subject to tidal action. It occurs in the baylands from the lowest areas with vascular vegetation to the top of the intertidal zone. Tidal marsh plant communities vary tremendously based on salinity, substrate, and water depth, and other factors like wave energy, marsh age, sedimentation, and erosion. There are three general zones of vegetation in tidal marshes: lower tidal marsh, middle tidal marsh, and upper (high) tidal marsh. The locations of these zones vary based on elevation and distance from shore, and are illustrated in Figure 2-13. At elevations below tidal marsh are the intertidal mudflats, shallow bay, and deep bay. Uplands are at elevations above the upper marsh.

Tidal marshes have a variety of important components including tidal channels. Both large tidal channels and smaller tributaries form a drainage network that distributes tidal waters throughout the marsh. For level marshes, channels tend to

be sinuous or braided; for steep marshes, channels tend to be straighter. Channel density, the amount of channel habitat per acre of marshplain, is directly related to *tidal prism*, the volume of water that flows into and out of the marsh. An upper marsh with a small tidal prism typically will have fewer channels than a lower marsh with a larger tidal prism. (Goals Project 2000~~.~~)

A *microtidal marsh* is a tidal marsh that receives a small tidal range, including marshes with naturally small tidal ranges (e.g. Gulf of Mexico). Tidal *choking* occurs when less than full tidal flow occurs because of a physical impediment. ~~Areas that do not receive full tidal flow are frequently~~ These areas are also referred to as being "muted." This muting can result from the presence of natural formations such as a sand bar or of human-made structures such as tide gates, culverts, or other water control structures. Muted tidal marshes exhibit many of the same features of fully tidal marshes, although they frequently lack the same range of plant diversity. Muted tidal marshes may be important to some wildlife groups such as shorebirds during the fall migration, but may also exclude other species. (Goals Project 2000~~.~~)

Also according to the Goals Report, a high-quality marsh has

- a natural transition to adjacent uplands,
- wide upland buffers to minimize human disturbance,
- connections with other large patches of tidal marsh that enable marsh-dependent birds and small mammals to move safely between them,
- pans in the marshplain and along the marsh/upland transition,
- other wetland types and mudflats nearby,
- a dominance of appropriate species of native plants and animals, and
- a minimum of uplands or structures intruding into or fragmenting the marsh to discourage predator access.

Tidal Wetland Restoration

Tidal wetland restoration involves hydrology, civil engineering, biology, and other scientific and engineering disciplines. This section provides a brief overview of the processes and factors involved in tidal wetland restoration. These factors were considered in developing the habitat restoration options described later in this section.

Tidal wetland restoration is a long-term process. As stated in the *Baylands Ecosystem Habitat Goals* report, produced by the San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project 1999) (pp. 149–150):

> Tidal wetlands take time to develop; when a site is restored, the initial set of habitat components will evolve for many years. After establishment, a tidal marsh with adequate sediment typically evolves in the following ways: (1) the drainage network becomes less complex, (2) remaining channels become deeper and narrower, (3) salinity gradients across the marsh plain become more variable

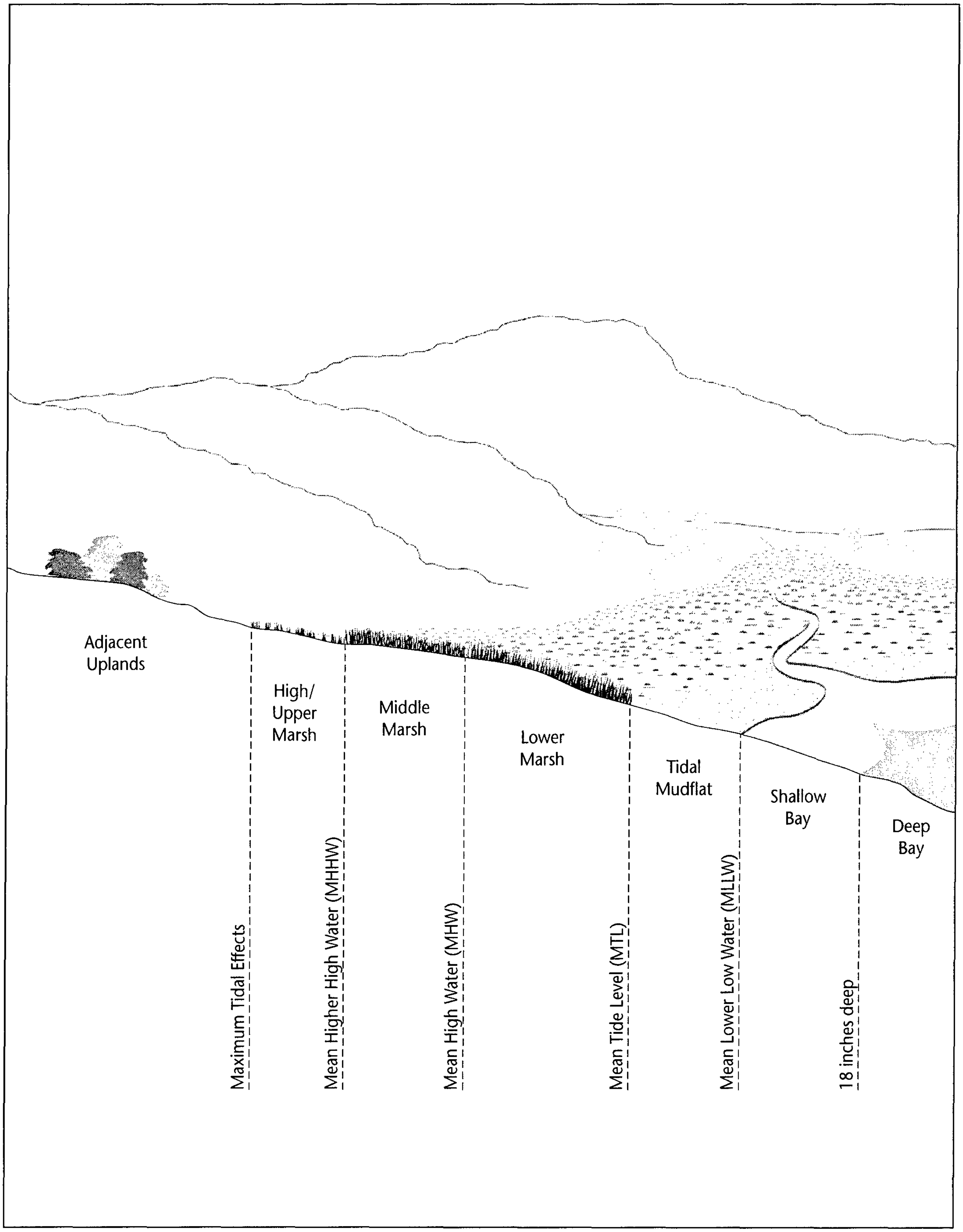

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Figure 2-13
Marsh Tidal Elevations

and steeper, (4) the amount of marsh plain that is not directly serviced by any channel increases, (5) surface drainage decreases, and (6) the amount of pans increases. Even at restoration sites where there is rapid sedimentation (e.g., Pond 2A in North Bay and the Petaluma River Marsh), it may take many years, even decades, before the marshes exhibit a full array of habitat features.

~~Also according to the Goals Report, a high-quality marsh has~~

- ~~a natural transition to adjacent uplands,~~
- ~~wide upland buffers to minimize human disturbance,~~
- ~~connections with other large patches of tidal marsh that enable marsh-dependent birds and small mammals to move safely between them,~~
- ~~pans in the marshplain and along the marsh/upland transition,~~
- ~~other wetland types and mudflats nearby,~~
- ~~a dominance of appropriate species of native plants and animals, and~~
- ~~a minimum of uplands or structures intruding into or fragmenting the marsh to discourage predator access.~~

Tidal Habitat Evolution

During the evolution of subtidal areas (the elevations of most pond bottoms are at or below mean tide level [MTL]) to fully functioning marsh, there are typically a series of successive habitats. Initially, sediment is deposited in the subtidal areas and intertidal mudflats develop. As sediment continues to deposit, portions of the area reach elevations where colonization by lower marsh vegetation is feasible. Once lower marsh vegetation is established, it continues to trap sediment and organic detritus, and the elevation of the site increases further to middle marsh plain. Upper marsh may also form along the upland edge (preexisting high ground) such as the levees.

The habitat restoration options were analyzed by PWA to better characterize the evolution of the site over the next 50 years. Evolution of the project area was evaluated in terms of creation and loss of subtidal, intertidal mudflat, lower marsh, middle marsh (marshplain), and upland/transition habitats, both within the breached ponds and in the remnant slough channels between ponds. The analysis assumed that the rate at which marshes evolve after being opened to the tide is a function of

- initial site elevation;
- vegetation colonization elevations; and
- sedimentation rates, which vary depending upon suspended sediment supply, tidal inundation, and wind/wave resuspension.

The analysis also assumed good low-tide drainage within the ponds. Poor drainage can limit delivery to the ponds and impede establishment of vegetation.

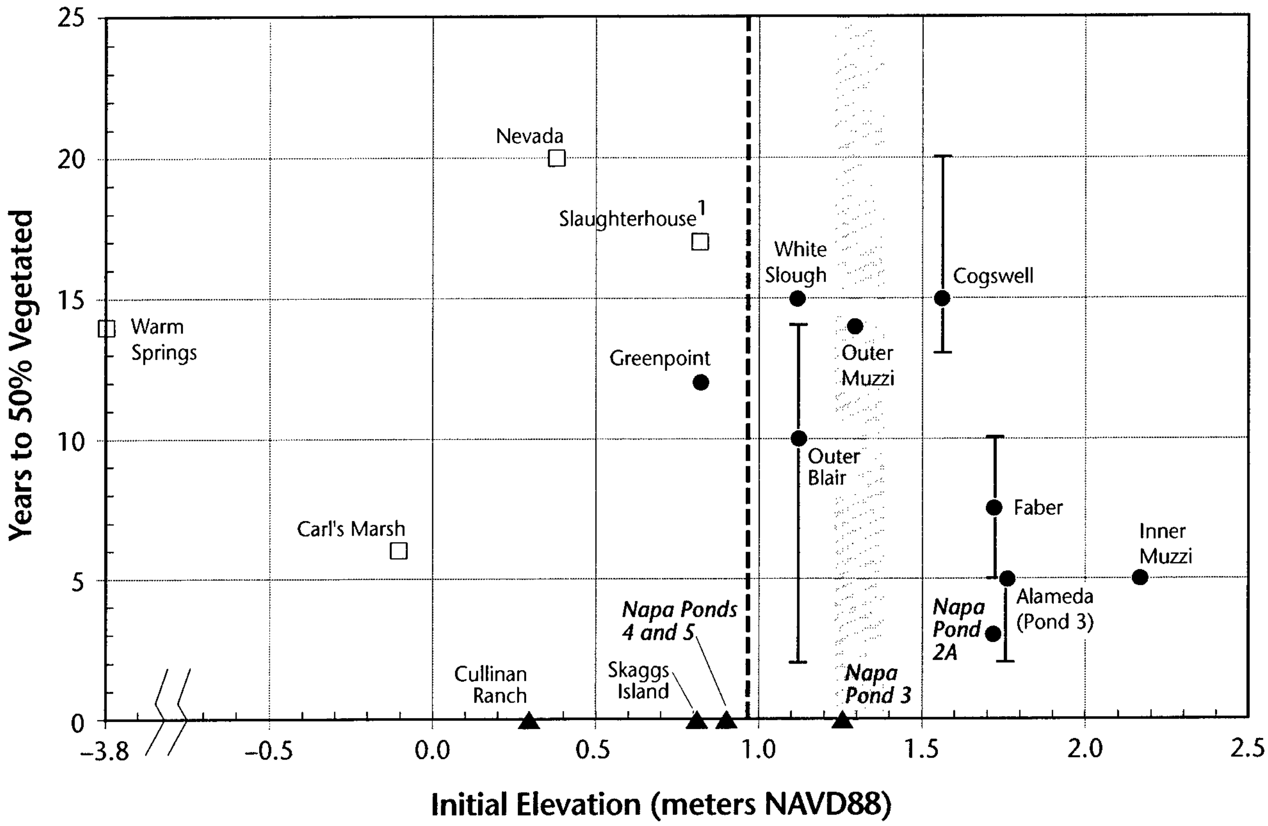
The initial site elevation of a restoration site greatly influences how quickly the site can be restored. Sites that are at or near the height required for initial vegetation colonization typically are restored much more quickly. Figure 2-14 compares initial elevation of restoration sites in the San Francisco Bay to the time it took for the site to reach 50% vegetative cover. The initial site elevations of the ponds in the Napa River Unit are shown in Figure 2-3. A digital elevation model of the pond interiors was used to calculate colonization as a function of elevation (Figure 2-15). As can be seen from Figure 2-15, all ponds are subsided below the level where vegetation colonization is expected to occur and Pond 3 is the closest to reaching an elevation suitable for vegetation colonization.

Vegetation colonization observed at other restored marshes in San Francisco Bay has been used to predict vegetation rates, patterns, and colonization relative to tidal elevations. It has been assumed for the ponds that initial colonization by lower marsh species (predominantly cord grass, bulrush, and cattail) would occur only on high-elevation mudflats, 0.3 meter above MTL and higher. Vegetation would extend to lower elevations through lateral colonization, down to MTL. Lower marsh vegetation is assumed to gradually increase in percent coverage. Once fully established (100% coverage), lower marsh is assumed to transition to middle marsh after 10 years. Middle marsh vegetation up to mean higher high water (MHHW) has been assumed to increase more quickly, from 0% to 100% over 3 years from initial colonization.

Since the ponds are subsided below vegetation colonization elevations in many areas, sedimentation rates will control the evolution of tidal habitats once the ponds are breached. According to the *Baylands Ecosystem Habitat Goals* report (p. 19),

> Although deposition rates vary around the Bay, tidal marshes eventually reach intertidal heights suitable for plants, and later, with the addition of organic sediment that the plants provide, the marshes reach equilibrium with sea level rise. Initial accretion rates of more than two feet per year are common in deeply subsided areas, but these rates decrease as the marsh plain rises... Tidal marsh restoration projects underway at several sites in the Estuary indicate that substantial accretion and re-colonization by marsh vegetation can occur quickly. For example, the Petaluma River Marsh has accreted sediment at a rate of about 1.5 feet per year since the site was opened to tidal action in 1996, and marsh vegetation is becoming well established (Siegel 1998). Marsh vegetation began to colonize Pond 2A in the Napa Marsh within six months after it was opened to tidal action in 1995 (Swanson, pers. comm.).

An initial assessment of existing sediment fluxes to the system compared to projected sediment demand by year with the restoration indicates that the current influx of sediment is more than the maximum demand. However, existing sediment supply may not be sustainable once the restoration occurs, because of the increased sediment sink and changes in the regional sediment budget. Conversely, sediment supply may actually increase as a result of the erosion of the existing tidal sloughs that run through the site. The uncertainty in the long-term sediment supply is considered in the phasing of the habitat restoration options.



● Age when 50% vegetated

□ Current age if not 50% vegetated (as of Year 2000)

▲ Planned Napa River Salt Marsh restorations

Notes:

Shaded vertical bar identifies the approximate *Spartina foliosa* colonization elevation.

Dashed vertical line indicates the minimum elevation for the lateral colonization of bulrush.

Error bars represent the range of uncertainty based on the data available to bracket the timeframe.

NAVD88 elevations are approximate.

[1] Damped tides for many years have slowed site evolution at the Slaughterhouse site.

Source: Philip Williams and Associates 2002.

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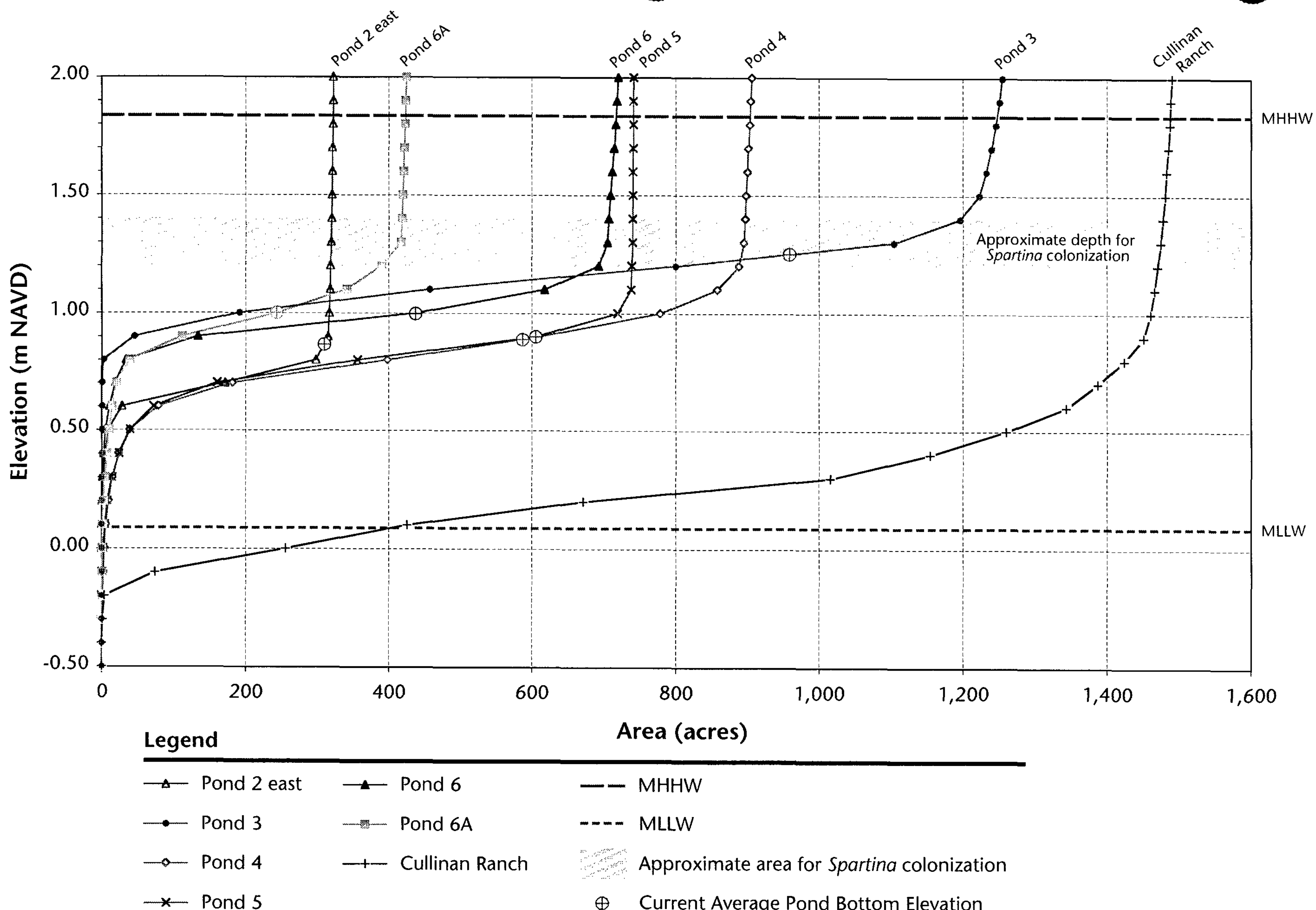
Figure 2-14
Initial Elevations and Years to Vegetation Establishment



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Source: Philip Williams and Associates 2002

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Figure 2-15
Plant Colonization as a Function of Elevation by Pond

Sedimentation is also affected by wind/wave action and by neighboring projects. Waves generated in the ponds by wind could reduce the sedimentation rates by either resuspending recently deposited muds or keeping suspended sediments from depositing. Cullinan Ranch, located between SR 37 and the project area, is owned by USFWS as part of the San Pablo Bay National Wildlife Refuge and is slated for restoration to tidal marsh in 20047 at the earliest. Once levees are breached, the demand for sediment in the Napa River Unit will increase, reducing the amount available to the breached ponds.

Design features can be used to speed marsh evolution and to nurture the evolution of marsh components. Faster marsh evolution would reduce potential impacts associated with fringing marsh habitat loss that would occur as a result of scouring of the existing slough channels (once ponds are breached and the tidal prism is increased). The following design features are being considered for the Napa River Unit:

- blocking the borrow ditches between the levee breaches with sediment to keep them from capturing tidal circulation;
- regrading a portion of the levees to an elevation of MHHW by sloping them into the ponds;
- excavating starter channels, and using the excavated sediment to create berms; and
- placing limited amounts of fill to speed initial vegetative colonization and offset short-term decreases in marsh habitat.

These design features are described below. The specific design features applicable to each habitat restoration feature are described under each of the habitat restoration options.

Ditch Blocks. A *ditch block* is simply an area of earth fill that crosses an existing borrow ditch or other channel to inhibit flow. *Borrow ditches* are humanmade drainage channels located adjacent to levees. The purpose of the ditch block is to inhibit existing borrow ditches from capturing the tidal supply and impeding reestablishment of the natural historic channels. Ditch blocks would be constructed based on a consideration of natural marsh morphology. Ditch blocks will be placed between levee breaches to avoid fish entrainment at low tide.

The levees adjacent to the proposed ditch block locations would be lowered to provide fill. Levees would be lowered close to MHHW to maximize generation of relatively dry earth, while maintaining a weight-bearing surface for construction equipment. The ditch blocks would be approximately 100 feet long and 40 feet wide at the top. They would have a finished grade of about MHHW with an average height of 4 feet, and 5:1 side slopes.

Levee Lowering. Levee lowering would consist of excavating the upper portion of an existing levee, and partially filling an adjacent borrow ditch or pond with the excavated material. Borrow ditches would not be filled completely; they

would allow continued movement of aquatic species. Levee lowering as referred to here would be in addition to that accompanying the construction of ditch blocks.

Levees would be lowered for several reasons. Levees are human-made features, and can provide access and habitat for predators that compromise the ecological objectives of restoration. Levees can also act as barriers to species migration by creating discontinuous habitat. The lowering of levees near large patches of fringing marsh to elevations consistent with upper marsh vegetation, particularly gumplant *(Grindelia stricta)*, can provide high-tide refugia for marsh species, reducing the risk of predation during high winter tides. The lowering of levees to elevations consistent with marsh vegetation where smaller sections of fringing marsh along slough channels are expected to erode can maintain connectivity between larger patches of fringing marshes, so that marsh species traveling between marshes are less subject to predation. Each habitat restoration option includes a total number of feet of levee that would be lowered, but the exact locations for levee lowering would be determined in consultation with resource agencies, in order to best serve marsh species. The figures for each habitat restoration option only show the initial work to identify sections of levees to lower; these figures are subject to change.

The crest elevation of certain sections of levees would be lowered to an elevation consistent with marsh vegetation and habitat. Levee lowering would consist of moving earth from the upper part of the levee sideways onto the back slope and into the adjacent borrow ditch, if appropriate.

Starter Channels and Berms. A *starter channel* is an excavated channel extending from a breach into a pond. Starter channels would benefit habitat restoration by facilitating more rapid channel and marsh development, and may increase the eventual density of channel drainage. Starter channels would help establish a desired channel pattern, typically similar to the historic pattern, which is likely to result in maximum habitat benefits. Starter channels would provide habitat for fish soon after construction, and would promote the more rapid formation of smaller channels that may ultimately become habitat for rails and other wildlife. The starter channels would also improve site drainage, which may enhance the rates of sedimentation and vegetation establishment.

A starter channel would typically follow a semisinuous path consistent with the historic channel path. The constructed cross section would be roughly trapezoidal. The optimal channel size is the estimated equilibrium channel size. However, actual channel dimensions may be smaller, depending on construction practicality and costs. For example, a much smaller channel can still provide benefit and a much larger channel can be constructed without adversely affecting the restoration. Starter channels could be excavated at some or all of the levee breaches.

Sediment excavated from the starter channels would be placed into berms. ~~on one or both sides of the starter channel.~~ A berm would likely be constructed on only one side of the channel, but berms could be constructed on both sides. The berms would be discontinuous so that side-channels are not obstructed. A *berm* is an

embankment of earth fill located within a pond. Berms would directly facilitate rapid development of a diversity of marsh habitat by providing ground elevations conducive to vegetation establishment. Berms would also facilitate marsh establishment by serving as dissipaters of wave energy, creating more sheltered conditions conducive to sedimentation and vegetation colonization.

The proposed berms would be located parallel to the starter channels. The berm crest elevation would vary around MHHW. The intent would be to create an irregular, wide, low-height mound with flat slopes and a sinuous shape roughly paralleling the starter channels. ~~A berm would likely be constructed on only one side of the channel, but berms could be constructed on both sides.~~

Fill Placement. This design feature would consist of placing up to 100 acres of earthen fill (sediment) into the southern portion of Pond 4, or a similar location with low historic channel density. The purpose of this fill would be to accelerate evolution to a vegetated marsh. The sediment would be placed no higher than 1 foot below MHHW elevation, to facilitate channel development on the new marsh. The fill could be placed by bucket or hydraulic means. Fill would be placed carefully to avoid creating undrained sections of the borrow ditch that could trap fish at low tide. Sediment would either be imported from a north bay source, or would be generated by dredging existing slough channels to deepen them. Any sediment used in this fill would be wetland cover quality.

Project Goals for Tidal Wetland Restoration

The goal of the project is to provide a mosaic of wetland habitats within the Napa River Unit, including tidal habitats and managed ponds. This mix of habitats would benefit a diversity of wildlife, including special-status species, migratory waterfowl and shorebirds, anadromous and resident fish, and other aquatic animals. All of the habitat restoration alternatives provide for a mix of tidal marsh and managed ponds, but vary in the extent of managed ponds restored to full tidal exchange.

Goals for tidal habitat restoration, which would include middle marsh, lower marsh, intertidal mudflat, and subtidal areas, are as follows:

- In a phased approach, restore large patches of tidal marsh that support a wide variety of fish, wildlife, and plants, including special status species.
- Create connections between the patches of tidal marsh (in the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.
- Restore tidal marsh in a band along the Napa River to maximize benefits for fish and other aquatic animals.

The approach to tidal restoration for ponds opened to tidal action is to enhance tidal circulation and sediment deposition to enable natural processes to gradually regenerate a self-sustaining marsh ecosystem. As noted earlier, a high-quality marsh is well drained, has an extensive channel network, and has other wetland

types nearby. Thus, the creation of a high-quality marsh ensures that other tidal habitats are also created.

Subtidal and mudflat habitat are the preliminary stages of tidal marsh restoration and also provide significant habitat values for invertebrates, birds, and fish.

Overview of Managed Pond Habitat and Pond Management

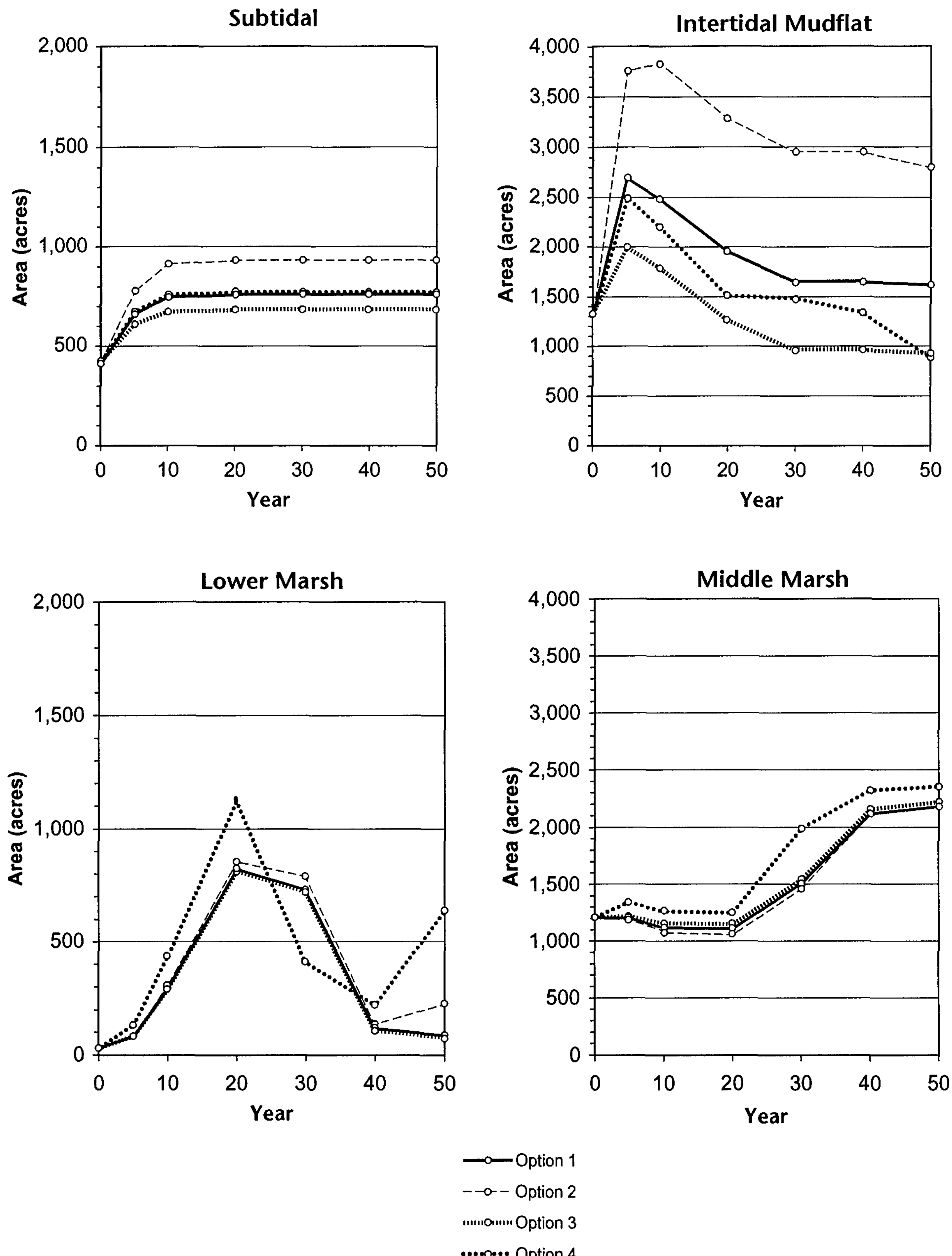
More than 7,000 acres of the Napa River Unit consist of inactive salt ponds that were used for salt production through the solar evaporation of bay water. These ponds, both historically and currently, serve as habitat for phytoplankton, invertebrates, fish, waterfowl, and shorebirds.

The habitat restoration options each provide for the continued management of at least five of the 12 ponds as ponds. Project goals for pond habitat are to enable DFG to better and more efficiently control water depth and salinity for the benefit of shorebirds and waterfowl. Waterfowl and shorebird use of the ponds is influenced by the water depth, salinity, and size of each pond. DFG will write a management plan for the Napa River Unit that will provide for pond management in the long term.

Levees and water control structures for all the ponds that would be preserved as ponds would need to be repaired or replaced so that salinity could be reduced in the short term and the water supply could be managed in the long term. The goal would be to maintain both the depth and salinity for a given pond within a specified range. The range would reflect the needs of different bird species likely to be present in the project area throughout the year, as well as seasonal variations. For example, it is likely that the managed ponds would have higher water levels and lower salinities in the winter (wet season) than in the summer (dry season). Water from the Napa River or Napa Slough would be added to ensure that the ponds do not drop below a certain critical depth, but the salinity of the water would increase during the dry season. Modeling suggests that the high evaporation rates during the dry season coupled with the increase in salinity in the intake water result in increases in salinity even when the water intake and discharge structures are left open to maximize tidal exchange. Recycled water could also be used to help maintain the levels in the ponds but would only be used until salinity is reduced in the upper ponds. Potential eutrophication concerns would have to be addressed if this approach is chosen.

Habitat Evolution

The various habitat restoration options would evolve over different periods of time (Figure 2-16) and achieve different mixes of habitats (Table 2-2). These habitat estimates are based on detailed modeling by Philip Williams and Associates (PWA) (Philip Williams and Associates 2002a) and provide a reasonable estimation of future site conditions given the habitat restoration



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Source: Philip Williams Associates 2002

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Figure 2-16
Habitat Evolution by Alternative

Table 2-2. Habitat Mix Associated with Each Habitat Restoration Option (Acres)

		Year 10				Year 50			
	Present	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Pond Interiors									
Subtidal	0	140	220	110	140	150	220	110	150
Intertidal mudflat	0	2,410	3,760	1,720	2,130	1,550	2,730	860	820
Lower marsh	0	260	280	260	400	50	190	50	610
Middle marsh	0	100	140	90	240	1,170	1,250	1,160	1,340
Managed ponds	6,460	3,550	2,080	4,290	3,550	3,550[a]	2,080	4,290	3,550[a]
Upland/transition	200	190	190	200	190	190	190	200	190
SUBTOTAL	6,660	6,660	6,660	6,660	6,660	6,660	6,660	6,660	6,660
Sloughs									
Subtidal	430	620	700	570	620	630	710	580	630
Intertidal mudflat	80	80	80	80	80	80	80	80	80
Lower marsh	30	30	30	30	30	30	30	30	30
Middle marsh (aka. Fringing marsh)	1,210	1,020	940	1,070	1,020	1,010	920	1,060	1,010
SUBTOTAL	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
Ponds & Sloughs									
Subtidal	430	760	920	680	760	770	930	680	770
Intertidal mudflat	80	2,490	3,840	1,790	2,210	1,620	2,800	930	900
Lower marsh	30	300	310	290	440	90	230	80	640
Middle marsh	1,210	1,120	1,080	1,160	1,260	2,190	2,180	2,220	2,360
Managed ponds	6,460	3,550	2,080	4,290	3,550	3,550[a]	2,080	4,290	3,550[a]
Upland/transition	200	190	190	200	190	190	190	200	190
SUBTOTAL	8,410	8,410	8,410	8,410	8,410	8,410	8,410	8,410	8,410
OTHER[b]	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
PROJECT TOTAL	9,460	9,460	9,460	9,460	9,460	9,460	9,460	9,460	9,460

[a] If Ponds 6 and 6A are also restored to tidal marsh after 10–20 years, the total area of managed ponds at year 50 would be 2,404 acres.

[b] "Other" category includes nonevolving marsh (the remaining fringing marsh and Pond 2A) and sloughs and upland habitat areas.

Note: The estimate assumes ~~Assumes~~ suspended sediment concentration ~~SSC~~ is 125 mg/l for Pond 3 and 75 mg/l for Ponds 4, 5, 6, 6A, and 2 East; also assumes a fill area of 100 acres for Option 4. Slough erosion occurs over 20 years with 50% by Year 5 and 80% by Year 10. Calculations do not include opening Ponds 6/6A to tidal action. Totals may not add up because of rounding.

Table 2-3. Approximate Dimensions of Design Elements

Design Element	Top Width (feet)	Key Elevations	Typical Side Slope[a] (H:V)	Length (feet)	Potential Middle Marsh Area Created
Breach	Approx. 100[b]	Invert 3–5 feet below MLLW	5:1	NA	NA
Pilot channel	~50	Minimum invert at least several feet below the marshplain	5:1	Varies	NA
Starter channel[c]	50–100	Longitudinal slope deepest near the breach (3–5 feet below MLLW) and shallower in the pond interior (1 foot above to 1 foot below MLLW)	5:1	Varies by option	NA
Berm[d]	Approx. 10	~MLHW to MHW at crest; no higher than +0.5 foot above MHHW	7:1	Varies by option	0.2 acre/1,000 feet
Ditch block[e]	40	~MHHW at crest	5:1	100	0.12 acre/block
Levee lowered to construct ditch block	30	~MHHW at crest	NA	330	0.23 acre/block
Additional levee lowering for high marsh restoration[f]	46	~MHHW at crest	NA	Varies by option	1.1 acre/1,000 feet
Fill placement	NA	~1 foot below MHHW	NA	NA	100 acres assumed, may be less

[a] Side slopes would vary, depending on constructability.
[b] Width at mean higher high water.
[c] Starter channels could be narrower and shallower, depending on cost and constructability constraints.
[d] The width of the lowered levee would be 30 feet. Material from levee lowering would be used to fill a 16-foot width of borrow ditch, giving an effective width of 46 feet for potential marsh habitat
[e] The width of the berm for Habitat Restoration Option 4 would be sized to allow the berm to serve as an effective wave break and may be larger than the width shown here.
[f] Three hundred thirty feet of levee would be lowered to provide material to construct a ditch block.

Source: Philip Williams and Associates 2002c.

approaches pursued under each habitat restoration option. The approximate dimensions of the design elements are provided in Table 2-3 and the number and length of the design elements, including middle marsh habitat created by option, are provided in Table 2-4. All habitat restoration options are assumed to begin after salinity reduction occurs for a specific pond/area.

The habitat restoration options and methods for implementing these options are described in greater detail in the following pages. The habitat restoration approaches include four options:

- Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds;
- Habitat Restoration Option 2: Tidal Marsh Emphasis;
- Habitat Restoration Option 3: Pond Emphasis; and
- Habitat Restoration Option 4: Accelerated Restoration.

Table 2-4. Number and Length of Design Elements and Middle Marsh Habitat Created, by Option

	Option 1	Option 2	Option 3	Option 4
Number and Length of Design Elements				
Breaches (number)	23	31	19	23
Ditch blocks (number)	22	23~~6~~	16	22[a]
Lowered levees[b] (ft)	22,200	34,600	14,600	22,200
<u>Berms[c]</u> (ft)	27,500	40,600	19,600	55,300
Starter channels[c] (ft)	27,500	40,600	19,600	55,300
Middle Marsh Area Created by Design Feature (ac)				
Ditch blocks	3	3	2	3
Lowered levees[d]	21	34	13	21
Berms	6	9	4	13
Area fill	-	-	-	100
Total	30	46	20	136

[a] Fewer ditch blocks may be needed, depending on the location of the fill placement.
[b] <u>Less levee lowering than indicated may occur.</u> Includes 330 ft. for each ditch block.
[c] <u>Fewer linear feet of starter channel and berms may be constructed, particularly for Pond 3.</u>
[d] Includes area of partial borrow ditch fill, except when that fill is a ditch block.

Source: Philip Williams and Associates 2002c.

Figure 2-16 and Table 2-2 indicate that Habitat Restoration Option 2 would result in the greatest increase in subtidal and intertidal mudflat habitats, and that Habitat Restoration Option 4 would result in the greatest increase in lower and middle marsh habitats. Habitat Restoration Option 3 would contain the largest area of managed ponds. For areas restored within Habitat Restoration Options 1, 2, and 3 these restoration efforts follow similar trends in the evolution of lower and middle marsh habitats, and are within 100 acres of one another until 40 years after restoration begins and more lower marsh evolves under Habitat Restoration Option 2.

<u>Habitat Evolution in Ponds 3, 4, and 5</u>

<u>Habitat evolution in the project area is dependent on a variety of opportunities and constraints (Philip Williams and Associates 2002c). The opportunities that lend themselves to restoration of the site include:</u>

- <u>hydrologic connection to tidal waters,</u>
- <u>suspended sediment supply,</u>
- <u>natural vegetative process and local seed sources,</u>
- <u>existence of historical antecedent channels,</u>
- <u>site elevations conducive to marsh vegetation establishment, and</u>

- connectivity with existing marsh.

The site constraints that could affect habitat evolution in the ponds include:

- subsided ground elevations below vegetation colonization elevations,
- availability of sediment as a limiting factor,
- loss of existing habitat,
- limitations to natural channel formation such as borrow ditches or hardened pond bottoms,
- flooding and infrastructure,
- levee stability,
- construction access,
- pond and tidal channel sediment characteristics,
- project size, and
- proposed Cullinan Ranch restoration.

Detailed information on each opportunity and constraint was developed and used for the restoration design process in an effort to estimate future conditions. It is predicted that the ponds will contain a full range of subtidal, microtidal, and tidal habitats depending on local elevations, tidal exchange, sediment deposition, grading, vegetation colonization, and other factors.

Modeling Methods and Assumptions

The methods and assumptions behind the analysis of the evolution of restored tidal wetland habitat are provided in *Napa River Salt Marsh Restoration Habitat Restoration Preliminary Design Phase 2 Stage 2 of the Hydrology and Geomorphology Assessment in Support of the Feasibility Report* (Philip Williams and Associates 2002c). The analysis was conducted for both pond interiors and major slough channels and consisted of a series of spreadsheet models that accounted for initial pond elevations, sedimentation, and vegetation colonization rates. The assumptions for pond interior restoration, specifically the sedimentation and vegetation colonization rates, were made following an extensive literature review, input from restoration planners, lessons from other restoration projects, and an analysis of the accuracy of the model predictions (i.e., a sensitivity analysis). The assumptions for the evolution of major slough channels focused on fringe marsh loss by slough channel erosion and rates of channel scour; these assumptions were made based on similar review of literature, consultation with experts, and lessons from other restoration projects. The Napa Sonoma Marsh Restoration Group and the Restoration Technical Advisory Group (RTAG) were involved in reviewing and approving the methods and assumptions.

Modeling Sensitivity and Habitat Variation

The modeling effort represents predicted future habitat evolution given many variables. PWA conducted a sensitivity analysis on variables such as tidal

damping, suspended sediment, wind-wave agitation, and channel erosion to determine the extent that these variables would lead to faster or slower marsh evolution. This analysis revealed that the proposed project tends to be optimistic in predicting marsh evolution, but that substantial areas of marsh will evolve even under conservative assumptions. Based on the sensitivity analysis, it is clear that the habitat mix associated with each habitat restoration option provides an estimate of the future conditions, but precise habitat acreage cannot be calculated. This is primarily because the restoration of natural marsh habitat relies on complex (i.e., multi-variate and non-linear) physical and biological processes that are inherently difficult to model and quantify with accuracy (Philip Williams and Associates 2002c).

Ecological Benefits

Irrespective of the exact number of acres of each habitat type that evolves, all habitat types will provide substantial ecological benefits. Subtidal and intertidal habitats will provide substantial benefits for invertebrate, fish, and some water birds. Lower marsh and middle marsh will also provide benefits for tidal marsh species, including birds and small mammals. There remains some uncertainty about the exact species composition and densities that will use the site; however, long-term monitoring will help resolve these questions. Furthermore, the project is designed to allow restoration of the site with a minimum of constructed features, allowing natural ecological processes to drive future site evolution.

2.5.4.2 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Introduction

Habitat Restoration Option 1 provides for a mosaic of tidal habitats and managed ponds. Under this option, the existing ponds would be restored as follows:

- Ponds 1, 1A, 2, and 2A would be maintained as they are, with levee repair and water control improvements as needed.
- Ponds 3 and 4/5 would be opened to the tidal prism in an orderly manner. Levee breaches would depend on accretion rates and sediment budget (Figure 2-17).
- Pond 6/6A would be maintained as a managed pond during the initial restoration of Ponds 3 and 4/5, an estimated 10–20 years. Adaptive management of the project would determine whether Pond 6/6A is converted to tidal marsh or retained as a pond in the long term. The decision is dependent upon success of tidal marsh development in Ponds 3 and 4/5, availability of other waterfowl and shorebird habitat, and funds available for O&M.
- Ponds 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels. Levees would be repaired and water control improvements would be made as needed.

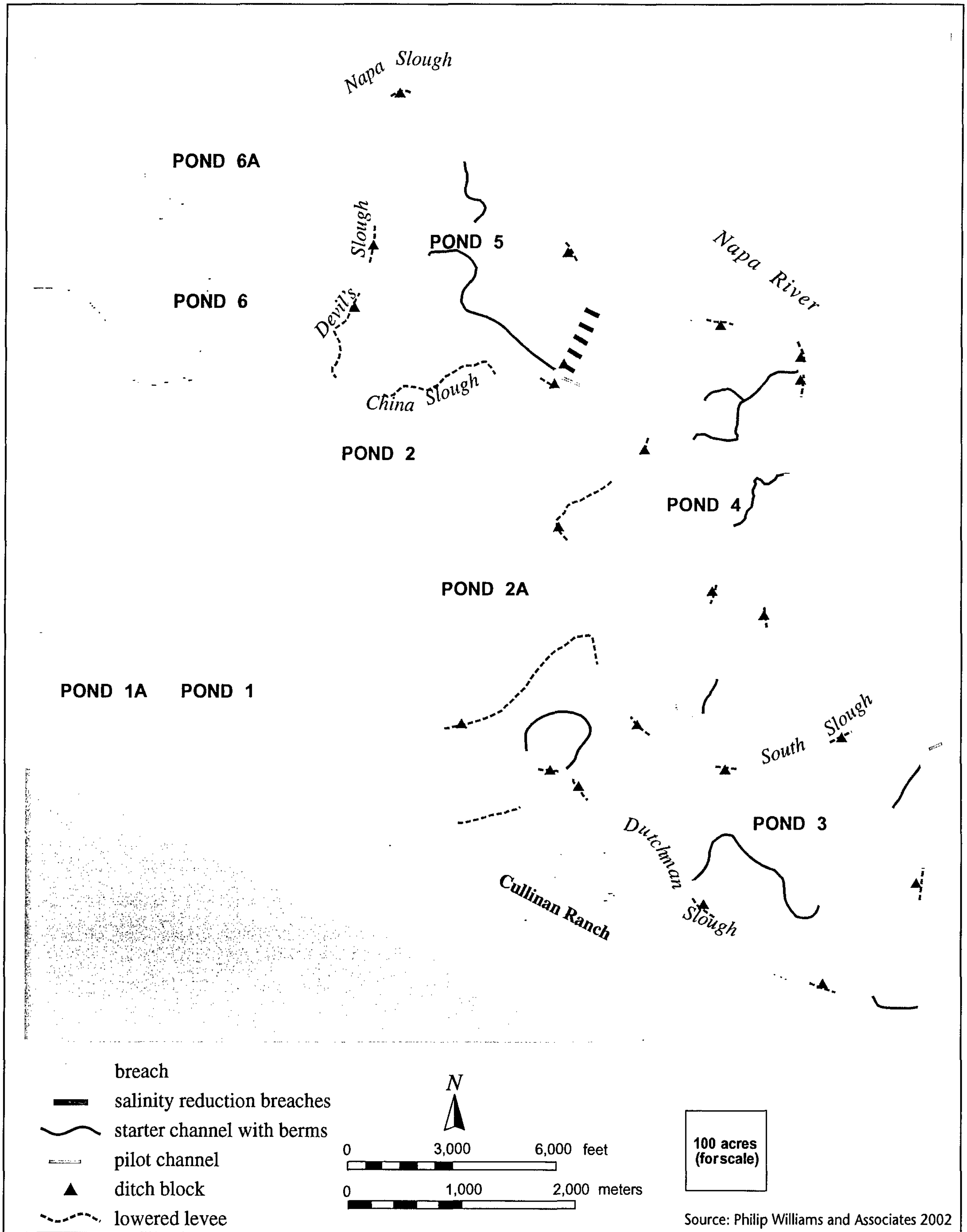

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Figure 2-17
Habitat Restoration Option 1: Mixture of Ponds and Tidal Marsh

Habitat Restoration Option 1 would lead to the following habitat distribution when the project has matured (Figure 2-18):

- Ponds 1, 1A, 2, 7, 7A, and 8: managed pond;
- Pond 2A and other existing tidal marsh and slough habitat;
- Ponds 3, 4, and 5: new tidal marsh, mudflat, slough, and open water;
- Ponds 6 and 6A:
  - short term—managed ponds;
  - long term—adaptive management approach (Option 1A, new tidal marsh, mudflat, slough, open water; or Option 1B, managed pond).

The evolution of habitat types is illustrated in Figure 2-19.

Ponds 1, 1A, 2, 7, 7A, and 8 (Managed Ponds)

Construction

Facilities. Water control structures would be repaired or replaced as needed. In particular, the siphon between Pond 1 and 2 would be refurbished or replaced with two 54-inch-diameter siphons, and the existing intakes and outlets at Pond 2 would be replaced with new culverts and pipes. (The siphon would have been refurbished and at least 1 siphon would have been installed as part of salinity reduction efforts, if Salinity Reduction Option 2 is implemented.) A 48-inch wide, 200-foot long culvert would be constructed from the donut to South Slough. DFG would also replace the existing 24-inch structure from the donut to Pond 1 and add a new 36-inch structure from the donut to Pond 1A. To further improve water quality, DFG would construct 5 100-foot long levee breaches between Pond 1and 1A. 2,000 feet of the All American Canal, near Pond 2, would also be lowered and breached in 4 locations. Breaches would be approximately 100 feet long. Some of the valves and related equipment on Ponds 7, 7A, and 8 may require replacement when these ponds are converted to managed ponds. Initial levee repairs for all of these ponds would have been completed as part of the salinity reduction effort.

Equipment. The estimated annual equipment required to complete maintenance, repair, and replacement activities for Ponds 1, 1A, 2, 7, 7A, and 8, including replacement of water control structures, is one or two barges, two long-reach excavators, a small bulldozer, refueling tanks, a diesel generator, and a small boat for transportation to and from the project site.

Timing and Duration. Construction activities are expected to be completed within 1 year.

Operations and Maintenance

Facilities. Ponds 1 and 1A would continue to be managed as ponds, and Pond 2 would continue to be managed as a deepwater pond. Ponds 7, 7A, and 8 would be variable-depth, managed ponds after the desalination process. Salinity and depth would be managed by DFG in Ponds 7, 7A, and 8 to provide habitat for migratory waterfowl.

Water control structures for all six ponds would require ongoing maintenance and possibly replacement in the long term (as long as these ponds are managed as ponds).

Equipment. See "Equipment" under the discussion of construction for ~~Habitat Restoration Option 1~~ Ponds 1, 1A, 2, 7, 7A, and 8 above.

Timing and Duration. Long-term maintenance and replacement of the water control structures would require several months of construction each year. Levee maintenance would consist of repairing approximately 5% of the levees each year.

Ponds 3, 4, 5, 6, and 6A (Tidal Habitat)

Construction

Facilities. Tidal habitat restoration activities for Ponds 3 and 4/5, and possibly Ponds 6 and 6A would be designed to facilitate evolution of the site to mature marsh. Activities for Ponds 3, 4, and 5 would include

- removing intake and outfall structures,
- constructing breaches that provide for optimal tidal exchange (23 breaches),
- breaching levees in areas with minimal existing marsh and near historical channels to minimize loss of fringing marsh and encourage the scouring of remnant slough channels,
- creating ditch blocks with associated levee lowering (22 blocks),
- ~~regrading~~ lowering additional levees in various areas ~~where habitat continuity could be disrupted during the restoration period~~ (22,200 linear feet), and
- installing starter channels and berms in the ponds (27,500 linear feet).

Habitat Restoration Option 1 relies on natural sediment processes for the majority of the restoration area, and on natural colonization by marsh vegetation.

Under this option, levees would first be breached to open Pond 3 to full tidal influence. The exterior levees on Ponds 4 and 5 would subsequently be breached. Ponds 4 and 5 are already connected to each other via a breache~~s~~ along the interior levee; ~~these~~ additional levee breaches would be ~~increased~~ installed as part of the salinity reduction effort (see "Salinity Reduction Options" above).

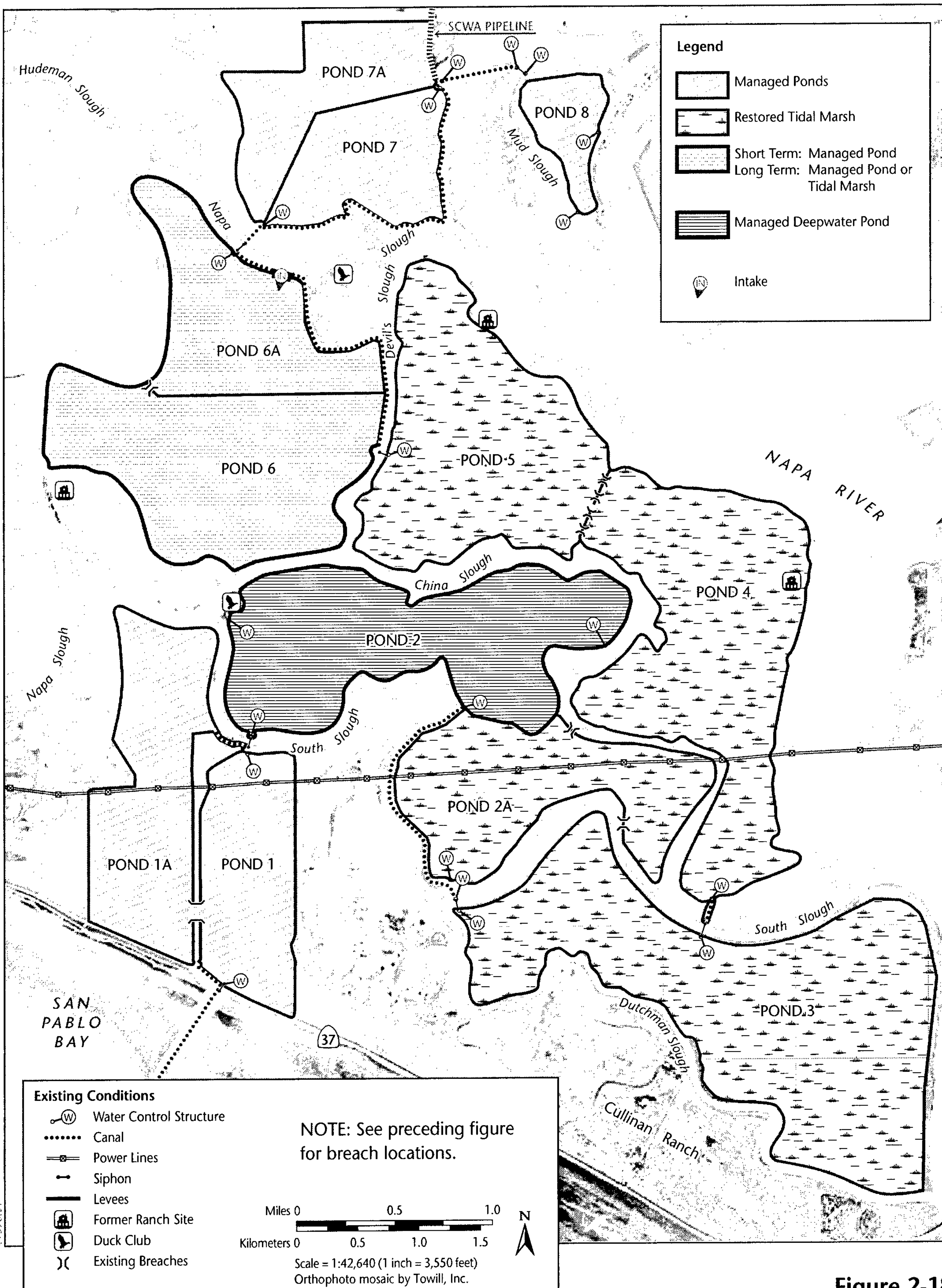

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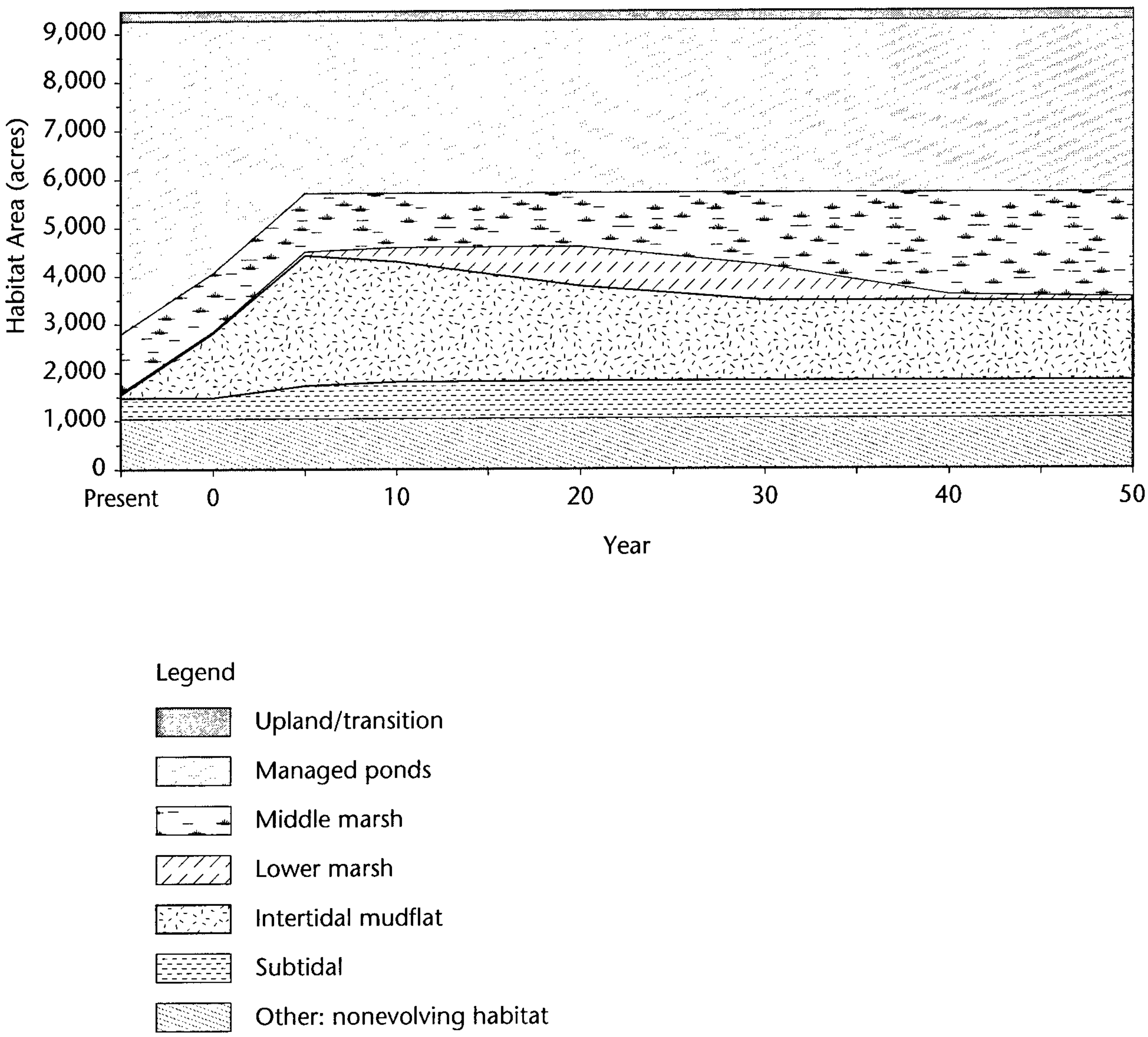
Figure 2-18
Habitat Restoration Option 1: Habitat Endpoints



Source: Philip Williams and Associates 2002

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Figure 2-19
Habitat Areas – Habitat Restoration Option 1

Equipment. Equipment used to create the habitat restoration features would be of the same types and quantities as those used during the salinity reduction process and would be delivered to the site in the same manner (via barge at high tide). Construction activities to restore Ponds 3, 4, and 5 to tidal action would consist of excavating or placing explosives to breach levees where needed, and using heavy equipment to remove intake and outfall structures, block the borrow ditches, reslope the levees near the breaches, lower levees, and excavate starter channels and construct berms.

Timing and Duration. Habitat restoration would begin upon the reduction of salinity in the ponds and would start with the breaching of the Pond 3 levees, likely proceeding as follows:

- The evolution of Pond 3 to vegetated lower marsh habitat is expected to happen within 10 years because its elevation is higher than those of Ponds 4 and 5.
- Within no more than 5 years after Pond 3 is opened to the tide (depending on the evolution of Pond 3 and the continued availability of sediment), the exterior levees on Ponds 4 and 5 would be breached.
- A decision regarding the long-term habitat at Ponds 6 and 6A would be made no later than 20 years after the start of the project. If these two ponds are opened to tidal action, it is likely that they would require a longer time to accrete to tidal marsh than the ponds located along the Napa River.

Operations and Maintenance

Facilities. Maintenance of Ponds 4 and 5 in the short term (until Pond 3 is sufficiently restored that they can be breached) would require ongoing operation and maintenance of the water control structures. Maintenance of Ponds 6 and 6A as ponds in the short term, and possibly in the long term, would require the repair of levees and ongoing maintenance and operation of water control structures. Ponds 6 and 6A would be managed as ponds for approximately 10–20 years, and would then either be restored to tidal marsh or continue to be managed as ponds, based on

- the availability of sufficient, high-quality waterfowl and shorebird habitat, including open-water habitat (Ponds 1, 1A, 2, 7, 7A, and 8), in the Napa River Unit and at nearby existing or restored sites;
- the success of tidal marsh restoration in Ponds 3 and 4/5 (success would be determined by percentage of marsh vegetation cover);
- the availability of funding for the operation and maintenance of Ponds 6 and 6A as managed ponds. Funds would be needed to maintain levees and water control structures and to operate the water control structures; and,
- the physical feasibility of operating these large, shallow ponds within the desired water level and salinity ranges.

~~Maintenance of Ponds 4 and 5 in the short term (until Pond 3 is sufficiently restored that they can be breached) would require ongoing operation and~~

~~maintenance of the water control structures. Maintenance of Ponds 6 and 6A as ponds in the short term, and possibly in the long term, would require the repair of levees and ongoing maintenance and operation of water control structures. Additional water control structures for Pond 6/6A, which would be required if Salinity Reduction Option 2 is implemented, would be constructed in the same manner as described for Salinity Reduction Option 1.~~

Equipment. Significant maintenance on or replacement of the water control structures and levee maintenance at Ponds 6 and 6A would be accomplished using heavy equipment delivered to the construction area by barge at high tide. The estimated equipment required to complete ongoing maintenance, repair, and replacement activities for Ponds 6 and 6A is one or two barges, two long-reach excavators, a small bulldozer, refueling tanks, a diesel generator, and a small boat for transportation to and from the project site.

Timing and Duration. Long-term maintenance would require several months of construction each year.

2.5.4.3 Habitat Restoration Option 2: Tidal Marsh Emphasis

Introduction

Habitat Restoration Option 2 provides for a mosaic of tidal habitats and managed ponds with an emphasis on tidal habitats. Under this option, the existing ponds would be managed as follows:

- Ponds 1 and 1A, the western half of Pond 2 (Pond 2W), and Pond 2A would be maintained as they are, with levee repair and water control improvements as needed. A new levee would be built down the middle of Pond 2 (Figure 2-20).
- Ponds 3, 4, 5, 6, and 6A, and the eastern half of Pond 2 (Pond 2E) would be opened to the tidal prism with levee breaches, in an orderly manner depending on accretion rates and sediment budget. Design features would be used as needed for improved accretion rates and habitat evolution. Pond 3 would be opened to tidal action first, followed by Ponds 4 and 5, then Ponds 6 and 6A and Pond 2E. Ponds 2E and 6/6A would be maintained as ponds, with levee repair and water control improvements as needed, until significant habitat development occurs in Ponds 3, 4, and 5.
- Ponds 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels, with levee repair and water control improvements as needed.

Habitat Restoration Option 2 would lead to the following habitat distribution when the project has matured (Figure 2-21):

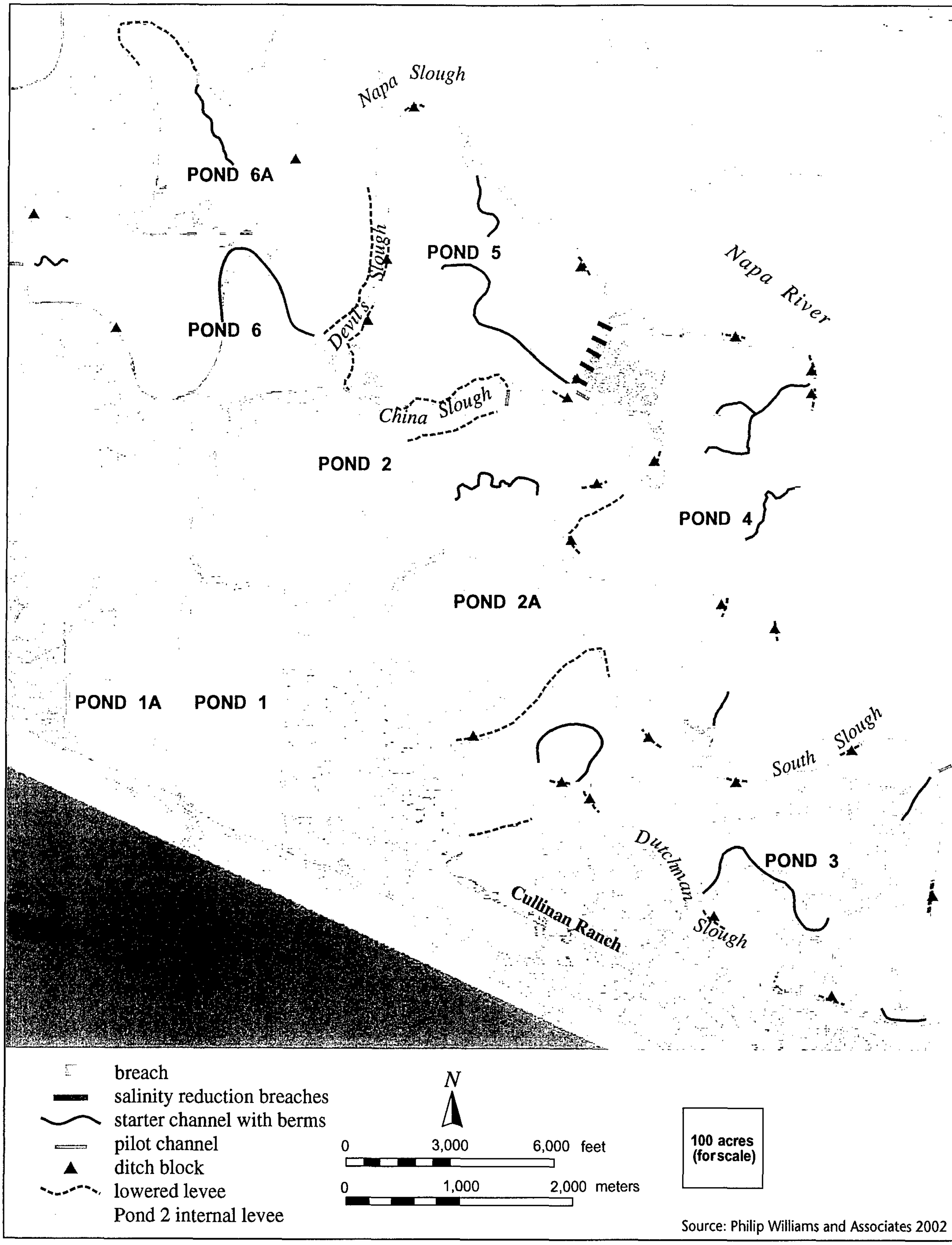

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Figure 2-20
Habitat Restoration Option 2: Tidal Marsh Emphasis

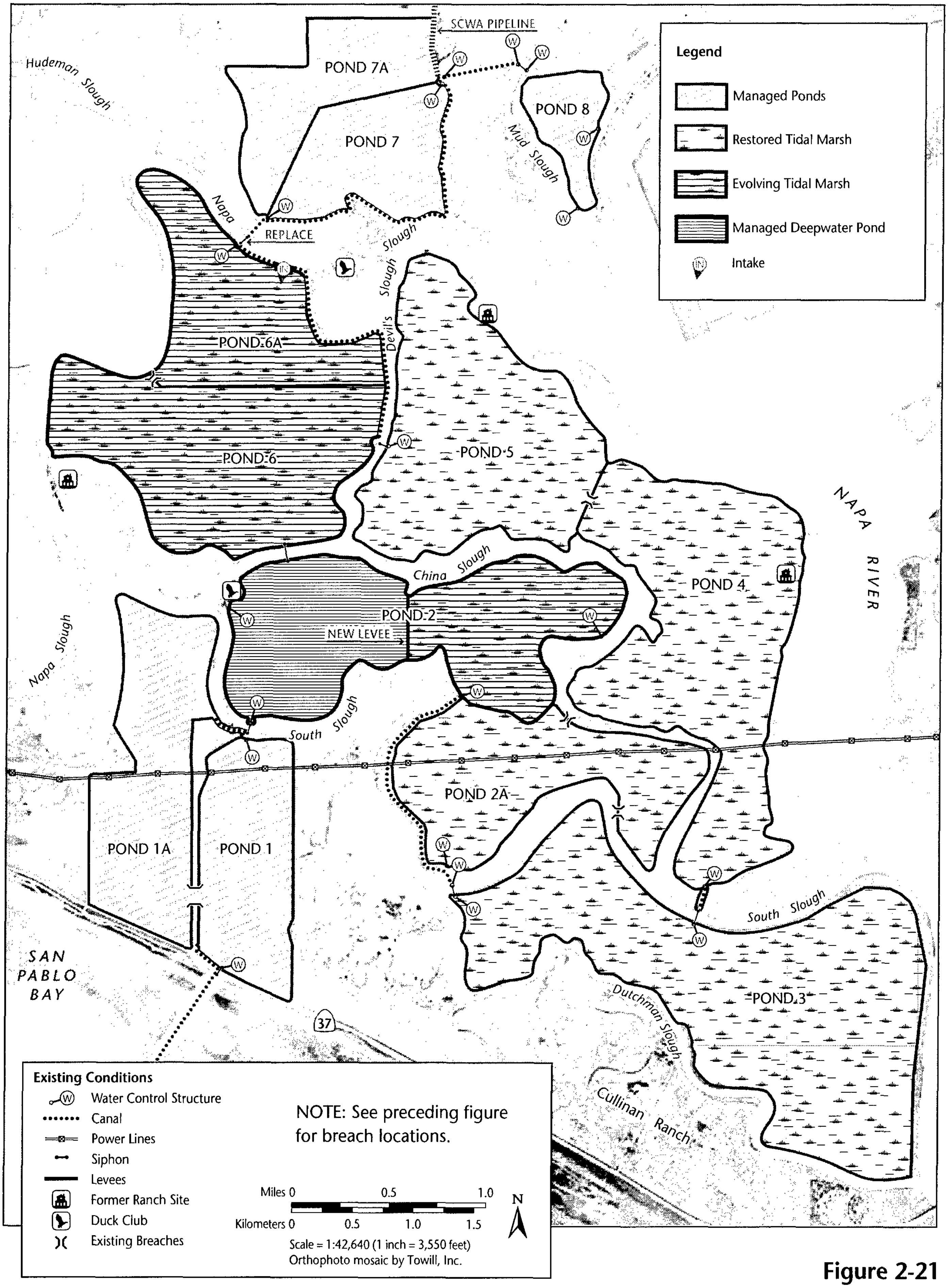

Figure 2-21
Habitat Restoration Option 2: Habitat Endpoints

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- Ponds 1, 1A, 2W, 7, 7A, and 8: managed shallow-water and deepwater pond habitat;
- Ponds 2E, 3, 4, 5, 6, and 6A: new tidal marsh, mudflat, slough, and open water; and
- Pond 2A and other existing tidal marsh and slough habitat.

The evolution of habitat types is illustrated in Figure 2-22.

Ponds 1, 1A, 2W, 7, 7A, and 8 (Managed Ponds)

Construction

Facilities. Levees would be repaired and water control structures would be repaired or replaced as needed. As under Habitat Restoration Option 1, initial levee repairs would be conducted as part of the salinity reduction effort. The water control structures installed as part of the salinity reduction effort would continue to be used for Ponds 7, 7A, and 8. Replacement of the Pond 1 pump station and refurbishing or replacement of the Pond 1 to 2 siphon may be required (if Salinity Reduction Option 1 is implemented).

Equipment. The estimated equipment required to complete the initial repair and replacement efforts for the water control structures is the same as for managed pond construction under Habitat Restoration Option 1.

Timing and Duration. As under Habitat Restoration Option 1, the length of time required for levee repairs or water control structure repair or replacement would depend on the amount of work needed.

Operations and Maintenance

Facilities. Ponds 1 and 1A would continue to be managed as shallow-water ponds and Pond 2W would continue to be managed as a deepwater pond. Ponds 7, 7A, and 8 would be managed as ponds after completion of the desalination process. DFG would manage salinity and depth in Ponds 7, 7A, and 8 to provide habitat for migratory waterfowl.

Levees and water control structures for these ponds would require ongoing maintenance and possibly replacement in the long term. Because of the demanding environment in which the water control structures operate, it is expected that knife valves and other features made of stainless steel would last for approximately 30 years. The pipes themselves would be made of HDPE, and are expected to last for the design life of the project (50 years).

Equipment. The estimated annual equipment required to complete maintenance, repair, and replacement activities for these ponds is the same as under Habitat Restoration Option 1.

Timing and Duration. Long-term maintenance and replacement of the water control structures and long-term maintenance of the levees would require slightly

less effort and would occur over the same period of time as under Habitat Restoration Option 1.

Environmental Commitments. The environmental commitments are the same as under Habitat Restoration Option 1.

Ponds 2E, 3, 4, 5, 6, and 6A (Tidal Habitat)

Construction

Facilities. Habitat restoration activities for Ponds 2E, 3, 4, 5, 6, and 6A would be designed to facilitate evolution of the site to mature marsh and would include the same features as under Habitat Restoration Option 1. The number of breaches and ditch blocks would increase relative to Habitat Restoration Option 1; the total length of starter channels with berms and levee lowering would also be greater. An estimated 31 breaches, 26 ditch blocks, and 40,600 linear feet of starter channels with berms would be constructed and 34,600 linear feet of levees would be lowered under this option. In addition, a new levee (1,800 feet long) would be constructed from north to south along the narrowest portion of Pond 2. A levee formerly existed in this area, but was allowed to disintegrate (Huffman pers. comm.). Finally, water control structures would be repaired as needed.

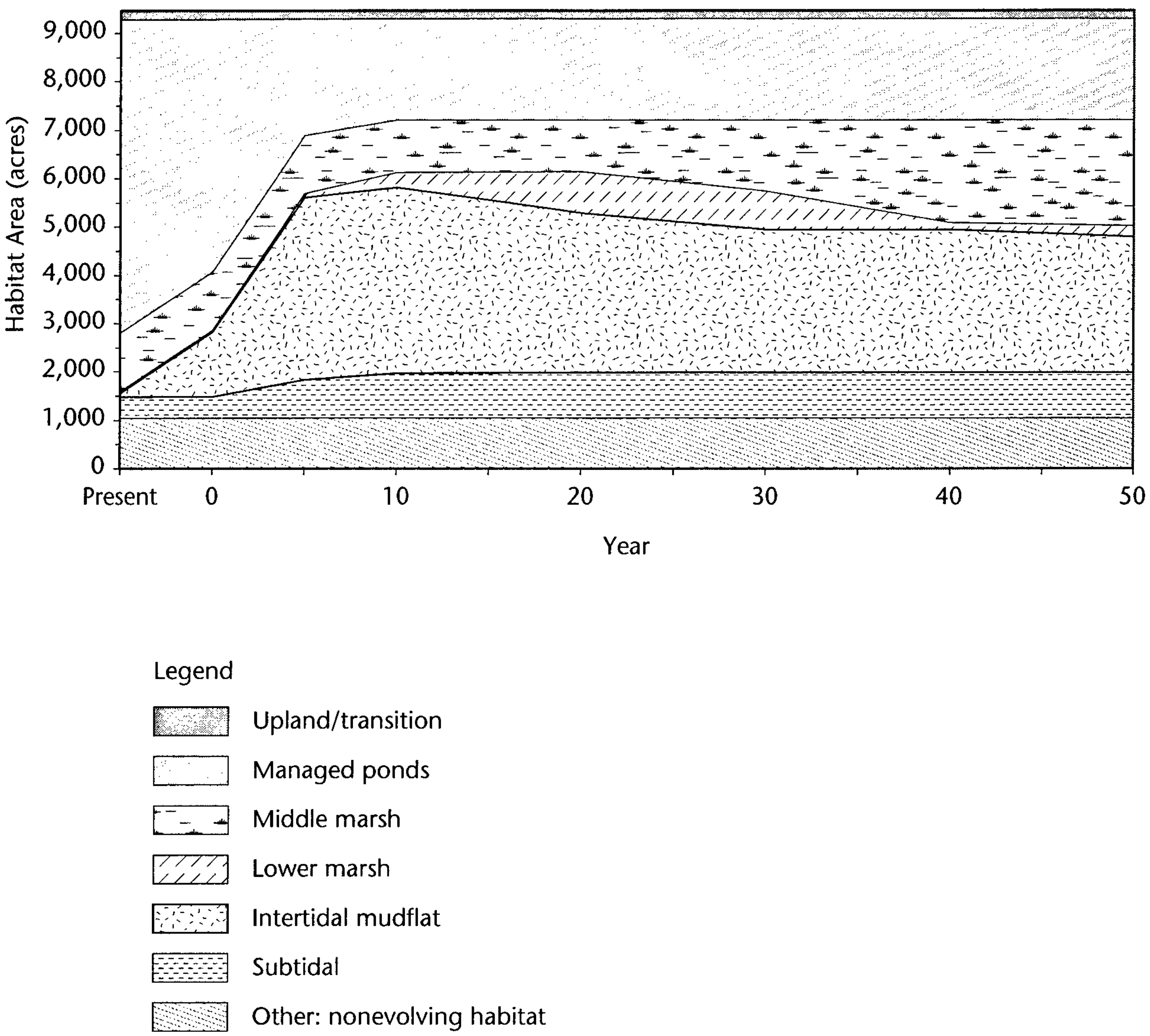
Equipment. Equipment used to construct the habitat restoration features would be of the same types and quantities as those used during the salinity reduction process and delivered to the site in the same manner (via barge at high tide). Construction activities to restore Ponds 2E, 3, 4, 5, 6, and 6A to tidal action would consist of excavating or placing explosives to breach levees where needed, and using heavy equipment to remove intake and outfall structures, block the borrow ditches, reslope the levees near the breaches, lower levees, and excavate starter channels.

Timing and Duration. The amount of time required to construct this portion of Habitat Restoration Option 2 is somewhat longer than that required for the tidal habitat for Habitat Restoration Option 1 because more breaches, starter channels, and ditch blocks would be constructed under this option. In addition, the construction of a levee would also be required. The levee would be constructed shortly before Pond 2E is opened to tidal action (to prevent circulation problems in the pond prior to breaching). It is estimated that the work required could be completed within a total of 18 months.

Operations and Maintenance

Facilities. Habitat Restoration Option 2 relies on natural sedimentation processes and on natural colonization by marsh vegetation to achieve marshplain elevations in the restoration area. Ponds 3–5 would be opened to tidal action and would generally be expected to accrete to marshplain elevations in the same sequence as under Habitat Restoration Option 1.

Ponds 2E, 6, and 6A would be managed as ponds, and would then be restored to tidal marsh, based upon the evolution of Ponds 3, 4, and 5 and the continued



Source: Philip Williams and Associates 2002

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Figure 2-22
Habitat Areas – Habitat Restoration Option 2

availability of sediment. Pond 2E is significantly subsided, which would slow marsh evolution.

Maintenance of Ponds 4 and 5 in the short term (until Pond 3 is sufficiently restored that they can be breached) would require ongoing operation and maintenance of any water control structures installed on the ponds. Maintenance of Ponds 2, 6, and 6A as ponds in the short term would require ongoing maintenance and operation of water control structures. Unlike Habitat Restoration Option 1, the levees on Ponds 2E and 6/6A would not require repairs (i.e., the ponds would be opened to tidal action before levee failure is likely to occur). Even if levee failure does occur, it is unlikely that the levees for these ponds would be repaired, because the ponds would be opened to tidal action at some point, salinities in the ponds would be low, and the size of the breach would also be relatively small.

Equipment. Repair of the water control structures for Ponds 2E and 6/6A, if needed, would be accomplished using heavy equipment delivered to the construction area by barge at high tide. Approximate types and quantities of equipment that would be used for the repair efforts include an excavator, a diesel-powered barge, and a small bulldozer.

Timing and Duration. Long-term maintenance would require several months of construction each year.

2.5.4.4 Habitat Restoration Option 3: Pond Emphasis

Introduction

Habitat Restoration Option 3 provides for a mosaic of tidal habitats and managed ponds, with an emphasis on managed ponds. Under this option, the existing ponds would be managed as follows:

- Ponds 1, 1A, 2, and 2A would be maintained as they are, with levee repair and water control improvements as needed.
- Ponds 3 and 4 would be opened to the tidal prism with levee breaches in an orderly manner depending on accretion rates and sediment budget. Pond 3 would be opened to tidal action first, followed by Pond 4 (Figure 2-23).
- Ponds 5, 6, 6A, 7, 7A, and 8 would be managed as ponds after their salinity has been reduced to ambient or near-ambient levels, with levee repair and water control improvements as needed.

Habitat Restoration Option 3 would lead to the following habitat distribution when the project has matured (Figure 2-24):

- Ponds 1, 1A, 2, 5, 6, 6A, 7, 7A, and 8: managed ponds;
- Ponds 3 and 4: new tidal marsh, mudflat, slough, and open water; and

- Pond 2A and other existing tidal marsh and slough habitat.

The evolution of habitat types is illustrated in Figure 2-25.

Ponds 1, 1A, 2, 5, 6, 6A, 7, 7A, and 8 (Managed Ponds)

Construction

Facilities. Levees would be repaired and water control structures would be repaired or replaced as needed. The same new structures and repair/replacement would be required as under Habitat Restoration Option 1 for Ponds 1, 1A, 2, 7, 7A, and 8. The overall construction effort would be somewhat greater than required under Habitat Restoration Option 1, because the levee breaches in the Pond 4/5 interior levee would have to be repaired, and levee repairs would also be required for the exterior levees at Pond 5. In addition, a new outfall would have to be constructed for Pond 5; this outfall structure would discharge to the Pond 4~~Napa River~~.

Equipment. Equipment required would be the same as for construction at Ponds 1, 1A, 2, 7, 7A, and 8 under Habitat Restoration Option 1.

Timing and Duration. The timing and duration of construction would be somewhat greater than that under Habitat Restoration Option 1 because construction required at Pond 5 would add to the time required to complete the work ~~take longer~~.

Operations and Maintenance

Facilities. Ponds 1 and 1A would continue to be managed as ponds, and Pond 2 would continue to be managed as a deepwater pond. Salinity and depth in Ponds 5, 6, 6A, 7, 7A, and 8 would be managed for shorebirds and waterfowl after the desalination process.

For all ponds, levees and water control structures would require ongoing maintenance and possibly replacement in the long term. Because of the demanding environment in which the water control structures operate, it is expected that any metal components would have to be replaced approximately every 30 years.

Equipment. The estimated annual equipment required to complete maintenance, repair, and replacement activities is the same as for Habitat Restoration Option 1.

Timing and Duration. Long-term maintenance would require several months of construction each year.

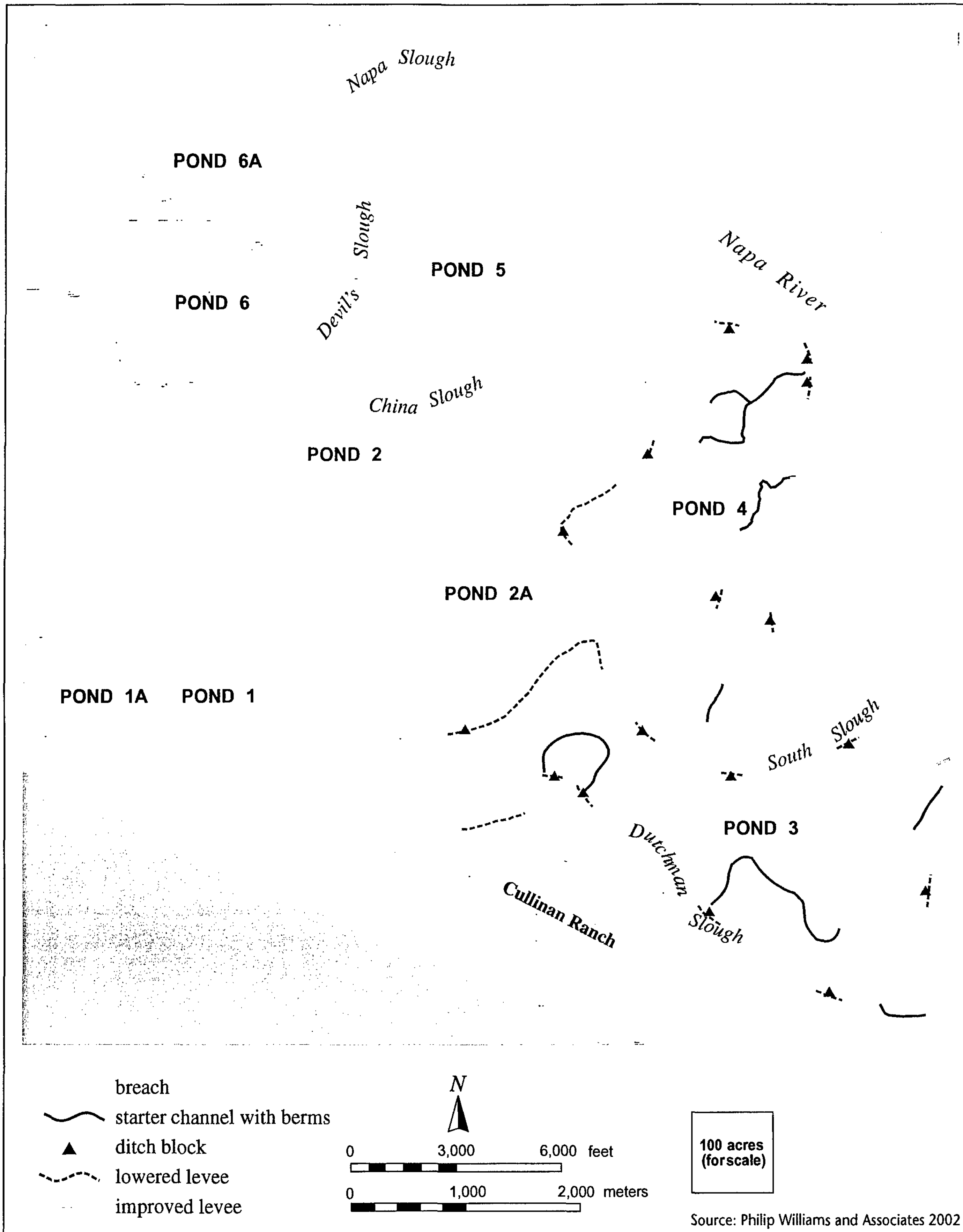

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Figure 2-23
Habitat Restoration Option 3: Pond Emphasis

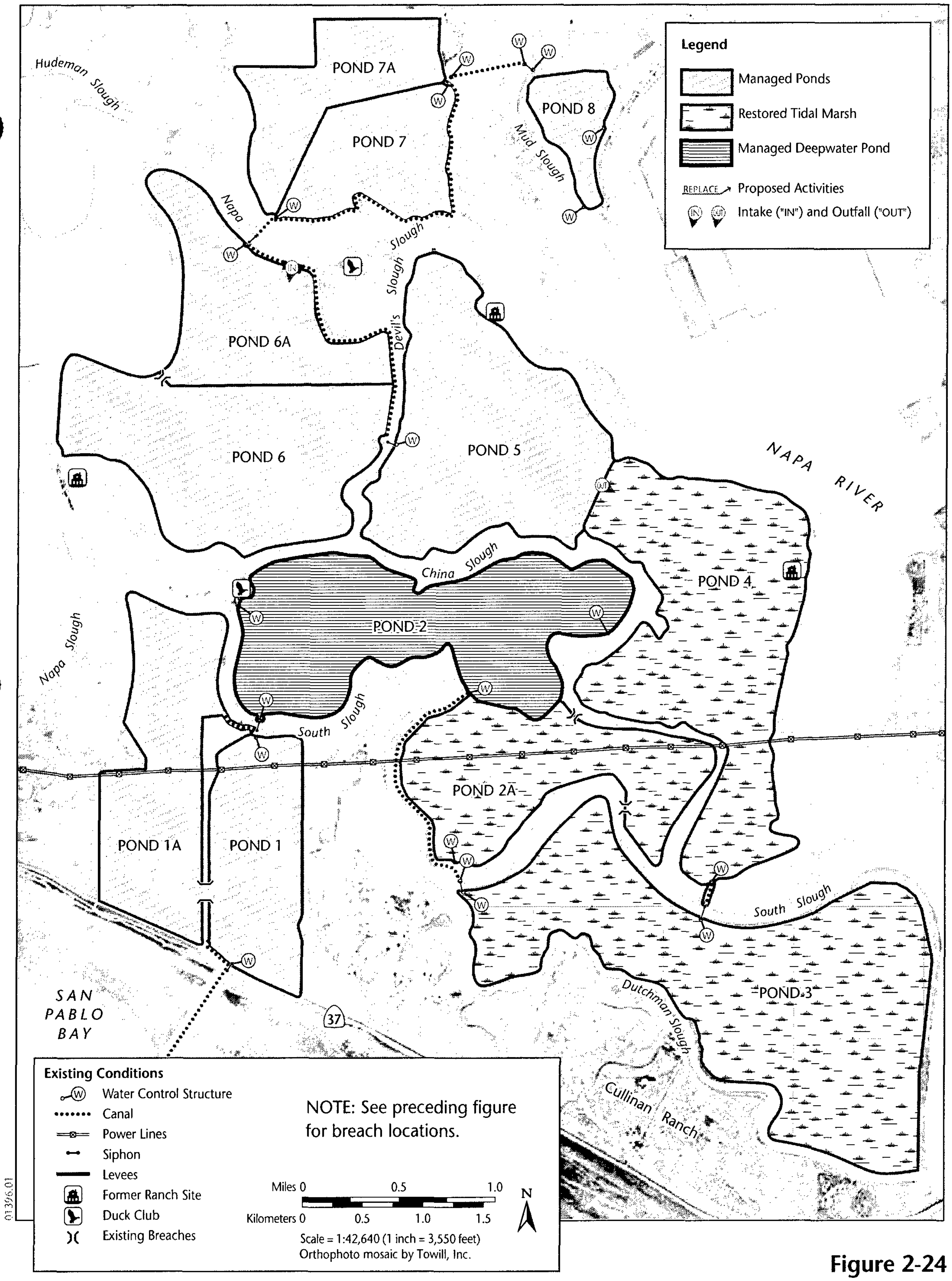

Figure 2-24
Habitat Restoration Option 3:
Habitat Endpoints

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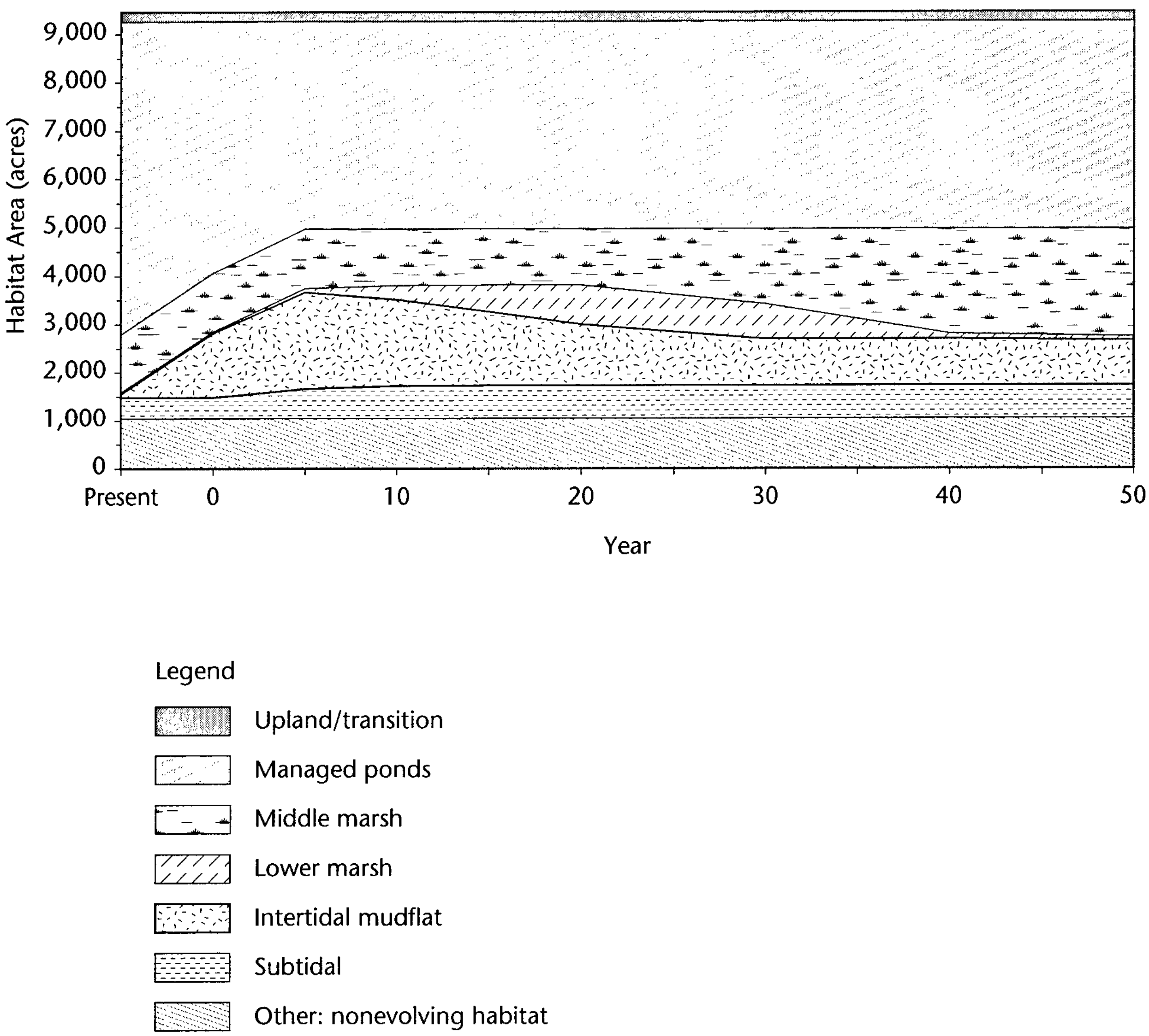

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Source: Philip Williams and Associates 2002

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Figure 2-25
Habitat Areas – Habitat Restoration Option 3

Ponds 3 and 4 (Tidal Habitat)

Construction

Facilities. Construction would include the same components as under Habitat Restoration Option 1. However, because only two ponds would be restored to tidal habitat, the number of breaches and ditch blocks would decrease to 19 and 16, respectively. There would be correspondingly less levee lowering (14,600 feet) and fewer starter channels with berms (19,600 feet) as well. No levee maintenance or repair or replacement of water control structures is required for this portion of Habitat Restoration Option 3.

~~Only minimal construction activities would be required at Pond 3; construction would be completed on the levee between Ponds 4 and 5 (see discussion above).~~

Equipment. Equipment used to construct the habitat restoration features would be of the same types and quantities as those used during the salinity reduction process and delivered to the site in the same manner (via barge at high tide). Construction activities to restore Ponds 3 and 4 to tidal action would consist of excavating or placing explosives to breach levees where needed, and using heavy equipment to remove intake and outfall structures, block the borrow ditches, reslope the levees near the breaches, lower levees, and excavate starter channels and construct berms.

Timing and Duration. The estimated time required to complete construction activities is 12 months.

Operations and Maintenance

Facilities. Habitat Restoration Option 3 relies on natural sedimentation processes for the ~~majority of the~~ restoration area, and on natural colonization by marsh vegetation. Under this option, Pond 3 would be restored to tidal marsh. Levee breaches would open Pond 3 to full tidal influence. The evolution of Pond 3 to marsh habitat is expected to happen fairly quickly because of the higher elevations of this pond. Within no more than 5 years after Pond 3 is opened to the tide (depending upon the evolution of Pond 3 and the continued availability of sediment), the exterior levees on Ponds 4 would be breached. The elevation of Pond 4 is slightly lower than Pond 3, so evolution to tidal marsh is expected to be slower.

Maintenance of Pond 4 in the short term (until Pond 3 is sufficiently restored that it can be breached) would require ongoing operation and maintenance of the water control structures.

Equipment. See "Equipment" under the discussion of construction of this option.

Timing and Duration. Only very short periods of time (several days per year) would be required to maintain the water control structures at Pond 4.

2.5.4.5 Habitat Restoration Option 4: Accelerated Restoration

Habitat Restoration Option 4 is identical to Habitat Restoration Option 1 in terms of the habitat mix; however, more extensive construction activities would occur at the ponds opened to tidal action. The additional construction activities, described below, are intended to accelerate marsh evolution (Figure 2-26). Figure 2-27 illustrates the habitat endpoints associated with this option, and Figure 2-28 illustrates the evolution of the habitat types associated with this option. The managed ponds (Ponds 1, 1A, 2, 7, 7A, and 8) would be constructed and operated in the same way as for Habitat Restoration Option 1, and are not discussed again here.

The added components included for Habitat Restoration Option 4 are as follows:

- **Filling of 100 Acres of Pond 4 (or a Similar Location).** Clean and local sediment would be placed in the southern portion of Pond 4, or a similar location with low historic slough channel density, to raise the pond elevation to within 1 foot of MHHW. This limited fill placement would speed initial vegetative colonization by raising the initial elevation of the site. This fill would help compensate for the anticipated temporary reduction in fringing marsh.
- **Increase in the Number and Length of Starter Channels and Berms.** The total length of starter channels and associated berms would increase from 27,500 feet to 55,300 feet. The increased number and length of starter channels would increase the channelization within the marsh, and sediment transport into the interiors of the ponds. The increased amount of berms would provide more wave breaks, more sacrificial sediment sources, and more opportunities for early colonization by marsh vegetation.

The addition of these more extensive design features could accelerate the habitat evolution compared to the other habitat restoration options (Figure 2-16). The number of breaches and ditch blocks and the amount of levee lowering would be the same as under Habitat Restoration Option 1.

The additional design features would require additional construction work. Sediment for the 100-acre fill area would potentially be available from three sources: a former dredge spoil disposal area at Edgerley Island; deepening of existing slough channels; or maintenance dredging of the Napa River. In either case, the most likely dredge is a low-profile hopper dredge that would suction sediment from the bottom of the slough or the Napa River deepwater channel and pump it into the fill area. Any maintenance dredging sediment used to raise elevations in the interior of the ponds would first be tested to ensure that it meets wetland cover criteria.

If Napa River sediment is used, project-related impacts would be limited to discharge and placement of the sediment, as impacts associated with mobilizing the equipment and dredging the channel are addressed by the Corps' maintenance

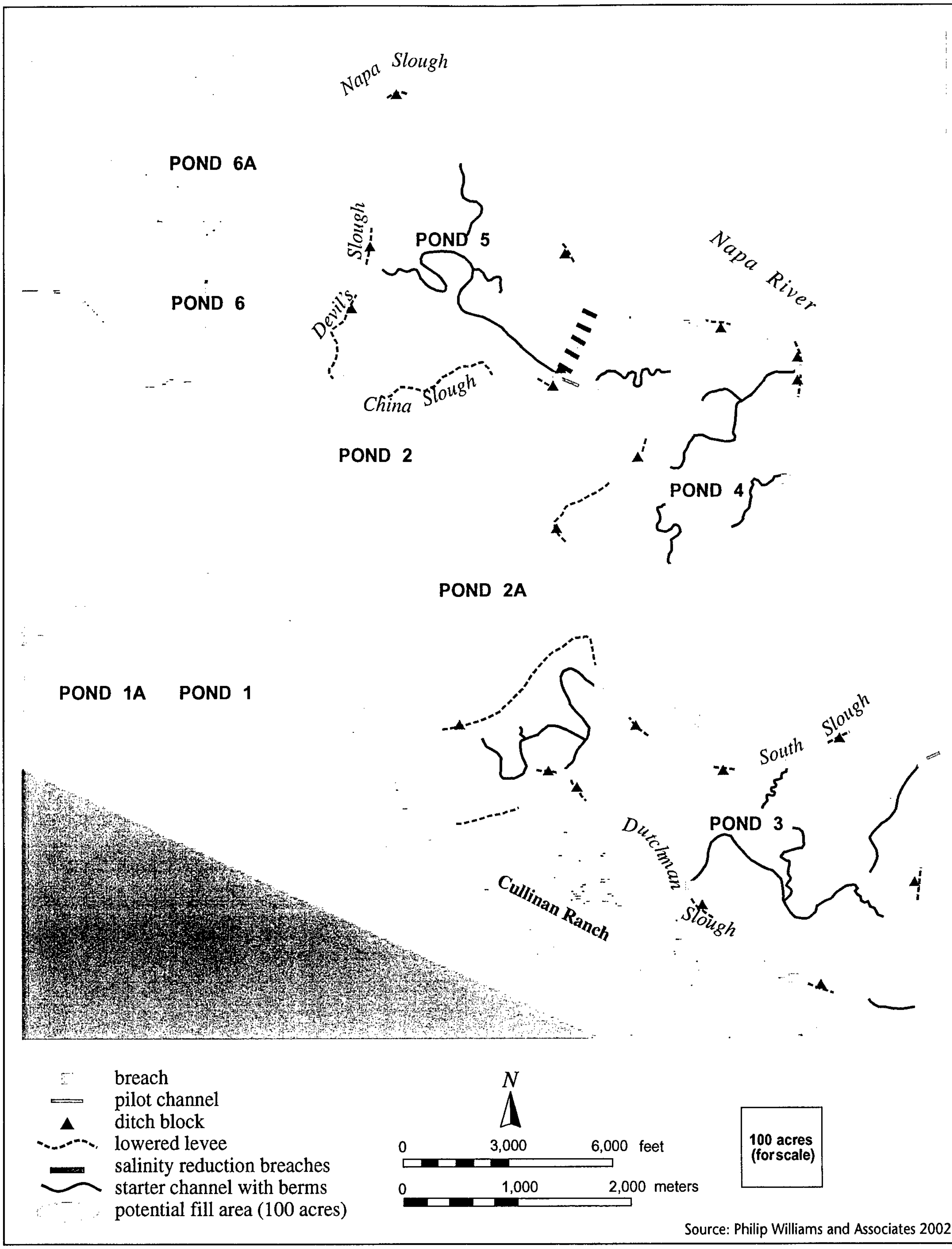

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Figure 2-26
Habitat Restoration Option 4: Accelerated Restoration

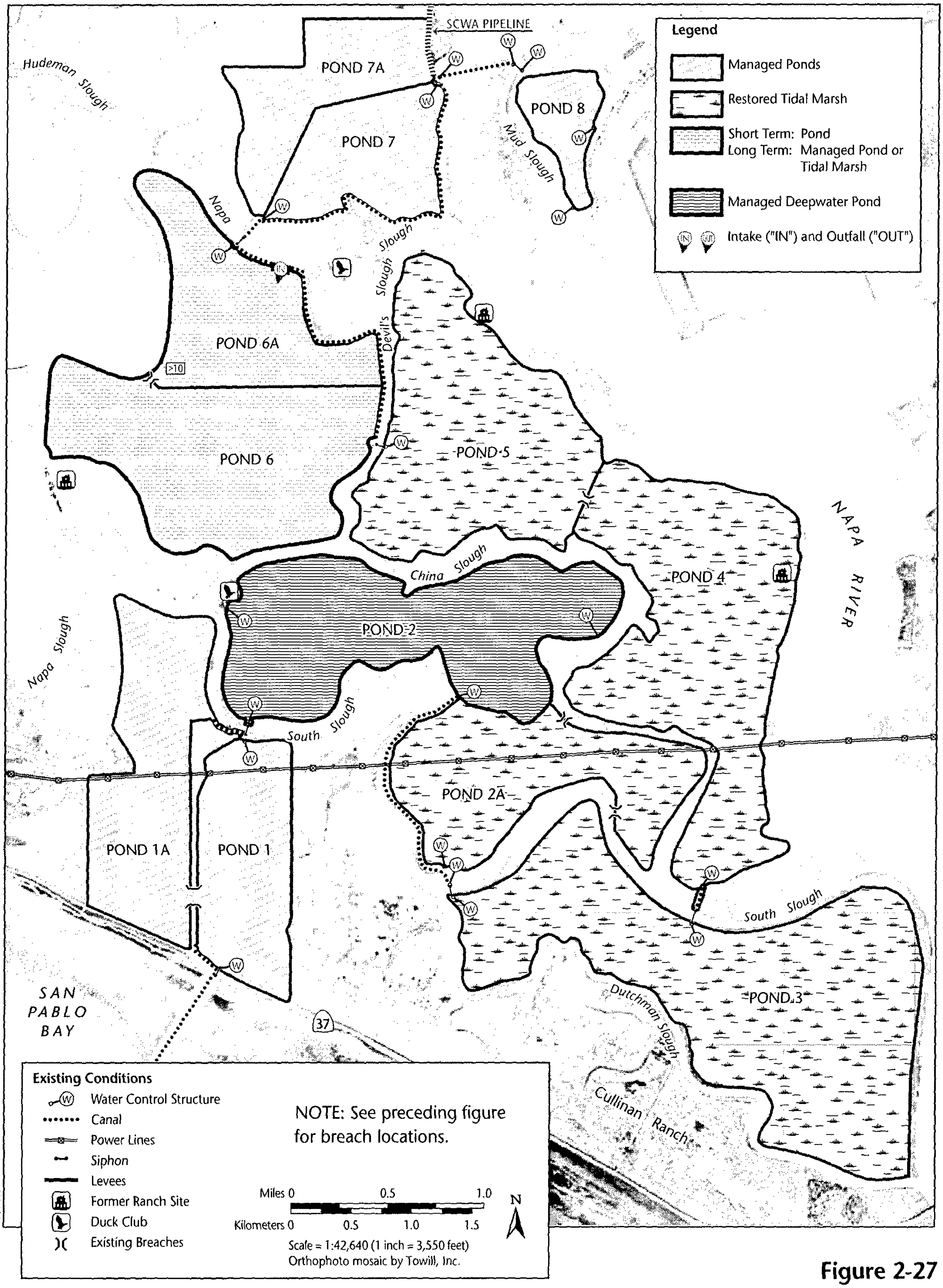

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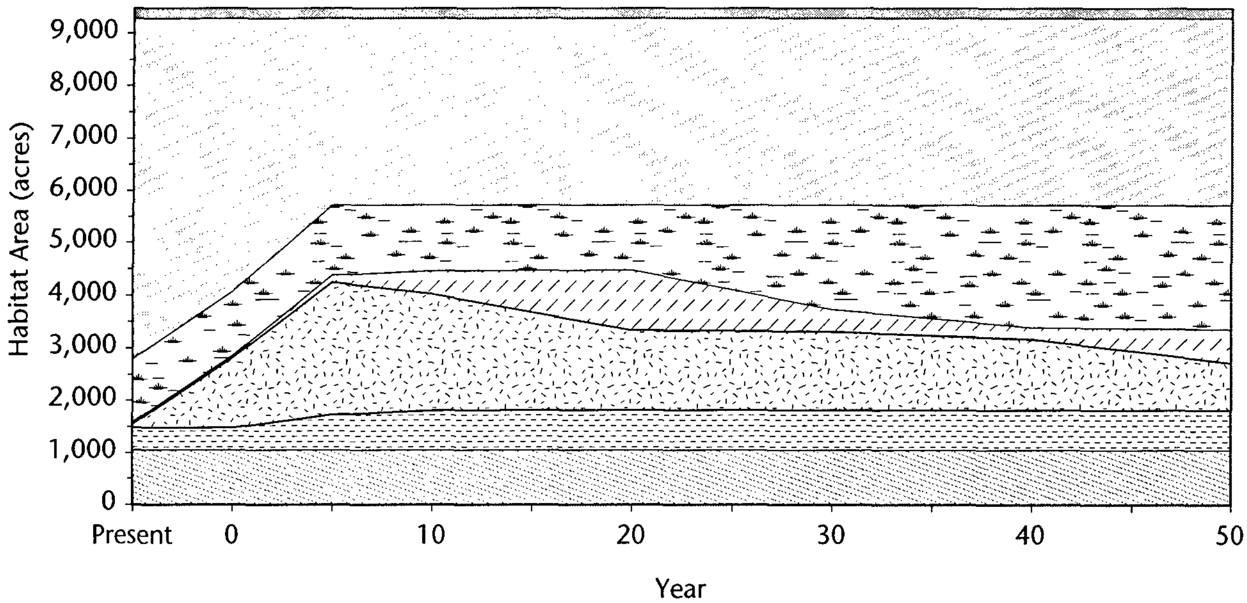
Figure 2-27
Habitat Restoration Option 4:
Habitat Endpoints



Legend

- Upland/transition
- Managed ponds
- Middle marsh
- Lower marsh
- Intertidal mudflat
- Subtidal
- Other: nonevolving habitat

Source: Philip Williams and Associates 2002

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Figure 2-28
Habitat Areas – Habitat Restoration Option 4

dredging program. Impacts associated with deepening existing slough channels would be considered entirely project-related.

2.6 Project Alternatives

Based on a detailed option screening process (Section 2.4, Development of Options) and alternative screening process (Chapter 17, "Alternatives"), the following nine alternatives were included for detailed analysis:

- No-Project Alternative;
- Alternative 1: Napa River and Napa Slough Discharge (Salinity Reduction Option 1A), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 2: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 3: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Tidal Marsh Emphasis (Habitat Restoration Option 2);
- Alternative 4: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Pond Emphasis (Habitat Restoration Option 3);
- Alternative 5: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4);
- Alternative 6: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5 (Salinity Reduction Option 1C), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 7: Napa River and San Pablo Bay Discharge and Breach of Pond 3 (slight modification of Salinity Reduction Option 2), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4); and
- Alternative 8: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), No Recycled Water, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1).

The specific components of these alternatives are described under Section 2.5, "Project Options."

2.7 Project Monitoring

The project sponsors are committed to ensuring that the options selected are implemented safely and minimize adverse environmental impacts. To this end

they have developed a draft monitoring plan to monitor, track, and evaluate changes in biological parameters. The construction monitoring and the salinity reduction and habitat restoration monitoring proposed for the project are described below and are illustrated in Figures 2-29 and 2-30.

2.7.1 Construction Monitoring

The available construction time is limited by protection periods established for endangered species. To minimize impacts on wildlife resulting from construction-related disruption and to minimize impacts on habitat, construction activities would be grouped by area. For example, all water control structures in a given area, fish screens, and monitoring equipment would be installed at one time. Construction of the required water control structures for all ponds would be completed as quickly as possible to allow improved management of pond water levels and ensure that salinity reduction can begin expeditiously.

The project sponsors will conduct preconstruction surveys for federally listed and state-listed plants and animals.

The Bay Area Air Quality Management District's (BAAQMD's) soil management best management practices (BMPs) would be implemented by the project sponsors and SCWA in areas with the potential to create airborne dust. These BMPs may include the following list.

- All construction areas, unpaved access roads, and staging areas will be watered as needed during dry soil conditions, or soil stabilizers will be applied.
- All trucks hauling soil or other loose material will be covered or have at least 2 feet of freeboard. Wherever possible, construction vehicles will use paved roads to access the construction site.
- Vehicle speeds will be limited to 15 mph on unpaved roads and construction areas, or as required to control dust.
- Streets will be cleaned daily to remove soil material carried onto adjacent public streets.
- Soil stabilizers will be applied daily to inactive construction areas as needed.
- Exposed stockpiles of soil and other excavated materials will be enclosed, covered, watered twice daily, or applied with soil binders as needed.

2.7.2 Salinity Reduction Monitoring: Water and Sediment Quality

Water and sediment samples from 40 sites within the pond complex, along with sites in the Napa River, Napa Slough, and San Pablo Bay were collected in October 2001 by HydroScience Engineers after development of the *Sampling and*

BROAD HYPOTHESES

1. The project planning objectives can be achieved employing selected salinity reduction and habitat restoration measures.

2. A mix of tidal habitat restoration and enhancement of managed ponds in the Napa-Sonoma Marshes is an important contribution to the recovery of sustainable populations of native fish, wildlife, and plants, including threatened and endangered species.

OBJECTIVES

1. To create a mix of tidal habitat and managed pond habitat to serve a broad range of wildlife, including endangered and threatened species, fish and other aquatic species, and migratory shorebirds and waterfowl.

2. To restore large areas of tidal habitats in a band along the Napa River to maximize benefits to fish and other aquatic animals, and ensure connections between the patches of tidal marsh (within the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.

3. To improve the ability to manage water depths and salinity levels in the managed ponds to maximize feeding and resting habitat for migratory and resident waterfowl and shorebirds.

SALINITY REDUCTION

HABITAT RESTORATION

TIDAL HABITAT RESTORATION

MANAGED POND ENHANCEMENT

HYPOTHESES *

1. The salinities of ponds can be reduced to allow tidal restoration or continued management as ponds, without negatively affecting aquatic species in the receiving waters.

2. Restoration of tidal habitats in Ponds 3, 4, and 5 is an important contribution to the recovery of sustainable populations of native fish, wildlife, and plants, including endangered and threatened species.

3. Large-scale tidal marsh restoration can be conducted using natural sedimentation.

4. The proposed tidal restoration design features will accelerate and enhance tidal habitat formation, will compensate for any short-term loss of tidal marsh in the project area, and will minimize negative impacts of increased tidal prism.

5. The depths and salinities of former commercial salt ponds can be sustainably managed, using predominantly tidally driven water control structures.

6. Managed ponds will provide habitat for resident and migratory shorebirds and waterfowl.

** See text for sub-hypotheses*

SUCCESS CRITERIA *

1. Salinity in ponds 3, 4, 5, 6, 6A, 7, 7A, and 8 will be reduced to salinity levels that meet discharge criteria and allow tidal restoration or that allow for continued management as ponds.

2. Applicable surface water quality standards are achieved both within the pond system and in the receiving waters.

3. The project area provides beneficial wetland habitat for an array of targeted native wildlife species, resulting in a net increase in biological diversity and productivity.*

4. Invasive plant species and introduced predators are not negatively affecting populations of targeted native wildlife.

5. A stable sediment deposition process is established in the ponds opened to tidal action, and quantifiable evolution to tidal marsh habitat is occurring in ponds 3, 4, and 5.*

6. Fringe tidal marsh that is lost because of widening external slough channels is replaced by the formation of new vegetated tidal marsh within the ponds opened to tidal action.

2. Applicable surface water quality standards are achieved both within the pond system and in the receiving waters.

3. The project area provides beneficial wetland habitat for an array of targeted native wildlife species, resulting in a net increase in biological diversity and productivity.*

* See Text for additional information

MONITORING

Water quality and sediment within ponds (basic WQ parameters, grab samples)

Water quality and sediment in sloughs and Napa River (basic parameters, grab samples)

Wildlife in tidal habitats (plants, fish, invertebrates, mammals, birds)

Invasive plant and introduced predator monitoring

Marsh evolution in restored habitats (sediment, bathymetry, and vegetation colonization)

Hydrology and channel geomorphology within sloughs and restored tidal habitats

Water quality and sediment within ponds (basic water quality parameters, grab samples)

Wildlife in ponds (primary productivity, invertebrates, fish, birds)

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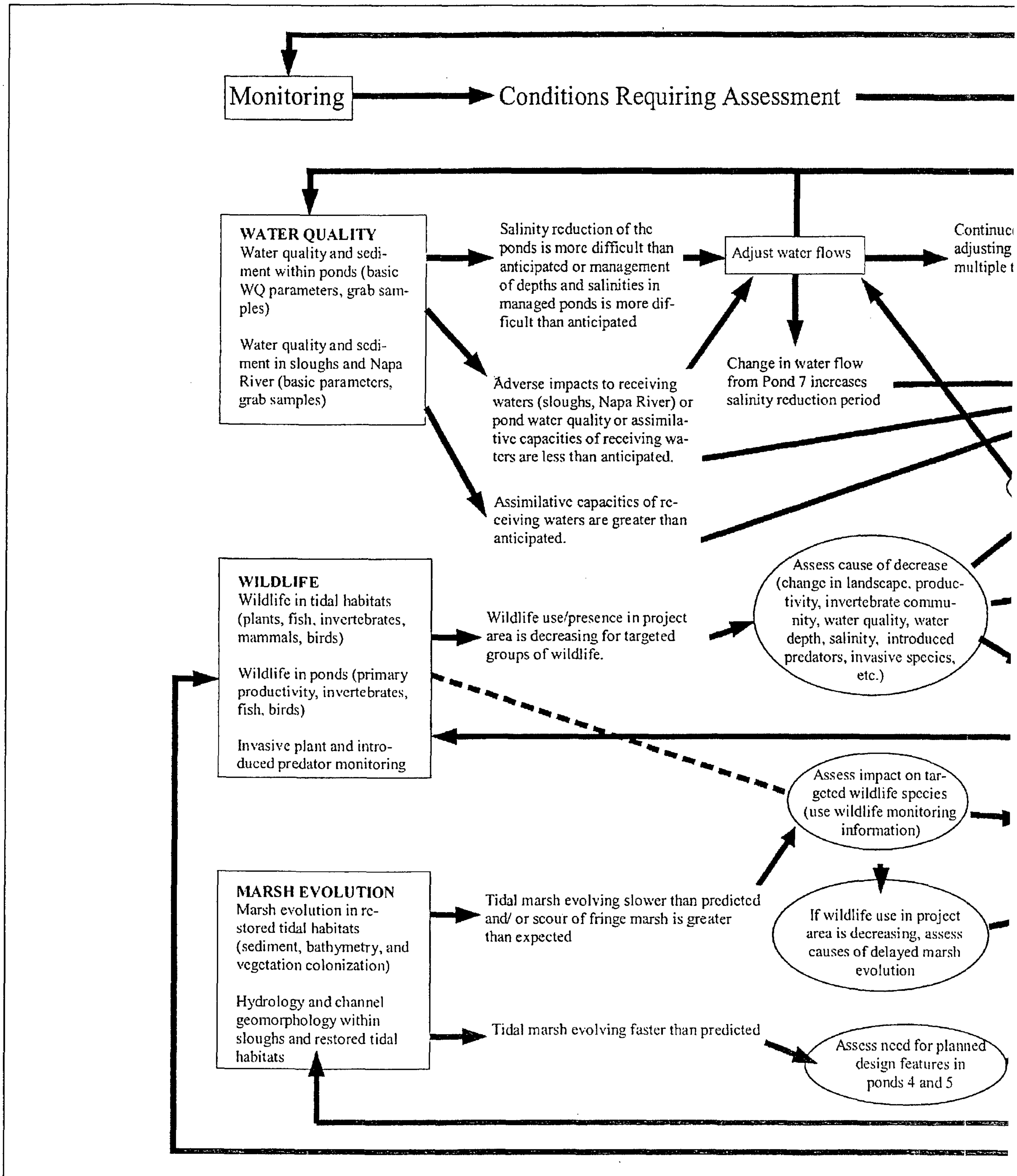
Figure 2-29
Project Objectives, Hypotheses, Success Criteria, and Monitoring


Monitoring
Conditions Requiring Assessment
WATER QUALITY
Water quality and sediment within ponds (basic WQ parameters, grab samples)
Water quality and sediment in sloughs and Napa River (basic parameters, grab samples)
Salinity reduction of the ponds is more difficult than anticipated or management of depths and salinities in managed ponds is more difficult than anticipated
Adjust water flows
Continu
adjusting
multiple
Change in water flow from Pond 7 increases salinity reduction period
Adverse impacts to receiving waters (sloughs, Napa River) or pond water quality or assimilative capacities of receiving waters are less than anticipated.
Assimilative capacities of receiving waters are greater than anticipated.
WILDLIFE
Wildlife in tidal habitats (plants, fish, invertebrates, mammals, birds)
Wildlife in ponds (primary productivity, invertebrates, fish, birds)
Invasive plant and introduced predator monitoring
Wildlife use/presence in project area is decreasing for targeted groups of wildlife.
Assess cause of decrease (change in landscape, productivity, invertebrate community, water quality, water depth, salinity, introduced predators, invasive species, etc.)
Assess impact on targeted wildlife species (use wildlife monitoring information)
MARSH EVOLUTION
Marsh evolution in restored tidal habitats (sediment, bathymetry, and vegetation colonization)
Hydrology and channel geomorphology within sloughs and restored tidal habitats
Tidal marsh evolving slower than predicted and/ or scour of fringe marsh is greater than expected
If wildlife use in project area is decreasing, assess causes of delayed marsh evolution
Tidal marsh evolving faster than predicted
Assess need for planned design features in ponds 4 and 5

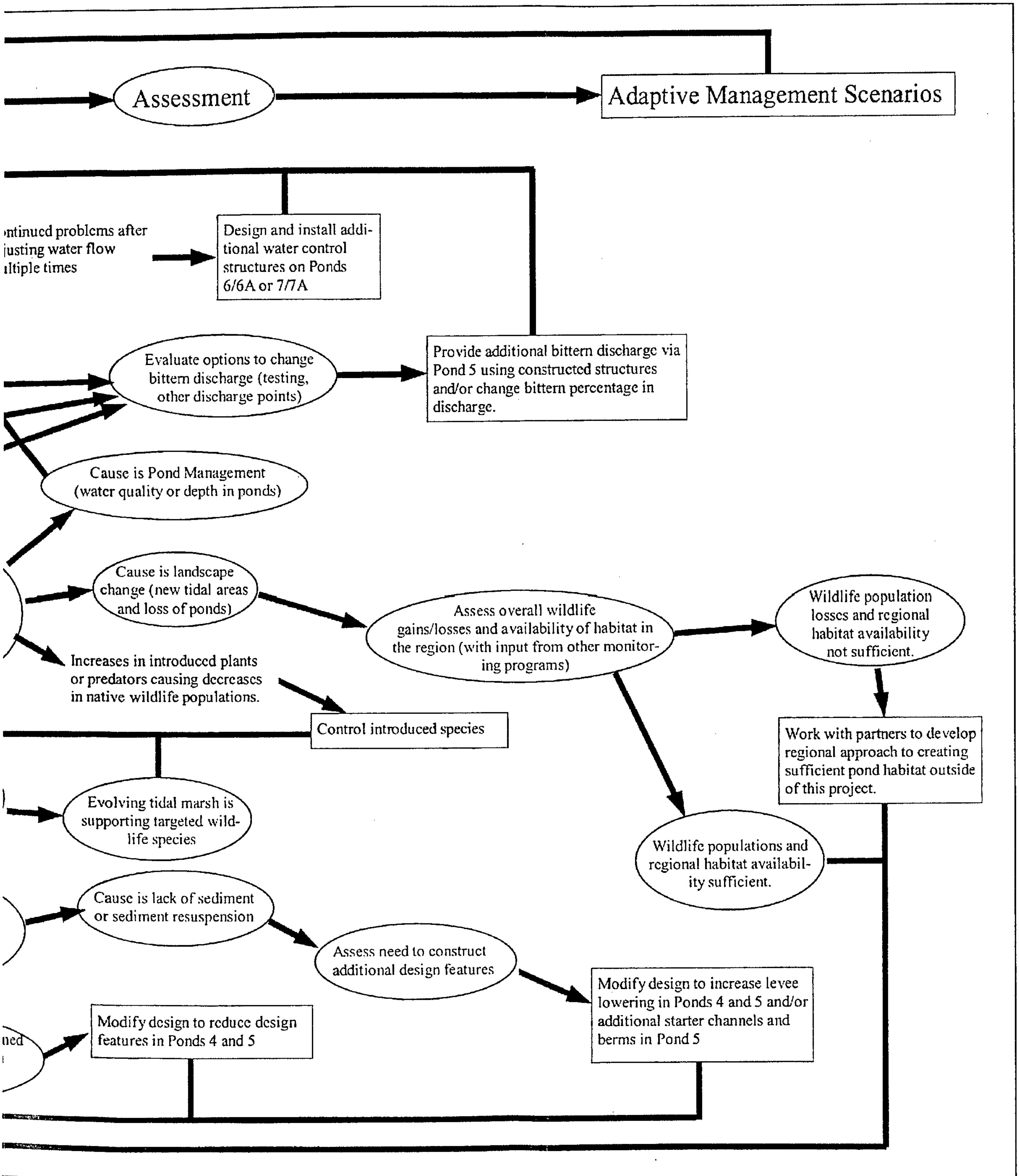


Figure 2-30
Adaptive Management Decision Matrix

2

Analysis Plan and Quality Assurance Project Plan, which was approved by the San Francisco Bay RWQCB (HydroScience Engineers 2001). Samples were analyzed by MEC Analytical Systems, Inc., for volatile and semivolatile organics, pesticides, polychlorinated biphenyls (PCBs), heavy metals, dioxins, and general water quality parameters, including nutrients, total dissolved solids (TDS), total suspended solids (TSS), pH, temperature, salinity, and dissolved oxygen (DO). Additional sampling was conducted in October 2003 for dissolved trace metals, TSS, pH, and salinity (Frontier Geosciences 2003).

A comprehensive water quality monitoring program would be prepared and implemented for the duration of the salinity reduction process. The monitoring would have well-defined data quality objectives, monitoring procedures, and data analysis and reporting protocols to ensure that project operations are controlled according to waste discharge requirements (WDRs) or the requirements of any National Pollutant Discharge Elimination System (NPDES) permit issued by the San Francisco Bay RWQCB. Monitoring at specific locations would be completed and phased out as each successive pond is restored and salinity has been reduced to ambient levels.

The discharge monitoring may ~~would~~ include continuous recording devices for key parameters and would include periodic grab samples for specific constituents of concern. If feasible, ~~M~~measurement of key continuous monitoring variables (flow, water level stage, salinity, temperature, and TSS/turbidity) would be implemented at several pond and receiving water locations to provide for real-time management of the intakes and discharges and ensure that changes in water quality would be within the acceptable range specified in the WDRs or NPDES permit requirements. Grab samples would be used to characterize long-term changes in other constituents of concern that might be identified by the resource agencies; these constituents could include dissolved oxygen, pH, or selected inorganic ions and trace metals. Aquatic toxicity tests ~~would~~ may also be conducted on a periodic basis.

2.7.3 Habitat Restoration Monitoring

USGS and DFG biologists and hydrologists, along with contractors as needed, would monitor the restoration project. The primary objectives of the monitoring are to evaluate changes in wildlife use of restored tidal habitats, ponds, and fringing marsh and physical evolution of restored tidal habitats and the external slough channels. Monitoring would occur during salinity reduction of each pond and continue for up to~~a minimum of~~ 10 years after ~~each~~ a pond is breached for tidal action.

USGS has been monitoring six ponds of varying salinities (Ponds 1, 2, 2A, 3, 4, and 7) since 1999. This interdisciplinary study, involving biologists and hydrologists, has included avian, macroinvertebrate, and fish surveys, along with collection of salinity and other water quality data in the ponds and collection of hydrodynamic, salinity, and suspended sediment concentration data in the sloughs. (Takekawa et al. 2001.) The ongoing nature of this monitoring effort

would allow for before-and-after comparisons of wildlife use, water quality, and physical processes.

Marsh evolution and wildlife use in the restored Pond 2A site was monitored first by PWA and then by MEC Analytical Systems, Inc., from 1996 to 2000 (Philip Williams and Associates 1997, MEC Analytical Systems 2000). The physical and biological evolution of the 550-acre Pond 2A marsh was monitored through surveys of levee breaching and equilibrium of the width of the natural slough channel, sediment chemistry and grain size, sedimentation rates, tidal range and response, fish usage, avian usage, and plant colonization. Although Pond 2A has different characteristics than the remaining ponds (Pond 2A was slightly less subsided and was never farmed before being converted to a salt pond), it can be used as one point of comparison. Comparisons would also be made to other restoration projects in the north bay region that are currently being monitored (such as Guadalcanal and Tolay Creek), and to the fringing marsh that exists along the slough channels within the salt pond complex.

USGS is also currently monitoring site conditions on Pond 3.

2.7.3.1 Marsh Evolution: Sedimentation, Hydrology, and Vegetation Monitoring

A topographic and bathymetric survey of the salt ponds, slough channels, and associated marsh plain was conducted by Towill, Inc., as part of the feasibility study with the Corps (Towill 2001). The aerial survey included a very accurate primary-control-level loop through the site that was connected to high-confidence benchmarks outside the site. This survey was used in the development of the hydrodynamic model by PWA and will be useful for before-and-after comparisons of elevations.

Sediment, hydrology, and vegetation monitoring would be conducted immediately before levee breaching to establish baseline conditions, and annually for up to~~approximately~~ 10 years after breaching. Prebreach monitoring would involve performing additional surveys for consistency with postproject monitoring locations, as well as installation of sedimentation monitoring stations. Postconstruction (postbreach) and some additional prebreach surveys of tidal geomorphic evolution would document rates and patterns of habitat evolution and key underlying physical processes in each pond restored to tidal habitats.

Monitoring results would be used to identify the need for any adaptive management required to improve tidal circulation within restored ponds. They would also be used to inform and adaptively manage the tidal wetland restoration designs for future tidal restoration in other ponds.

Sedimentation Rates

Sedimentation would be monitored to understand rates and patterns of marsh evolution within breached ponds. Sedimentation would be measured using methods such as marker horizons, sedimentation plates and pins, and topographic resurveys.

Levee Breach and Slough Channel Cross Sections

Cross-sectional surveys of levee breaches, external sloughs, and pond-internal sloughs and adjacent berms (if used) would be conducted to understand patterns of tidal scour and drainage and to determine when the widths and depths of the breaches and external and internal sloughs reach equilibrium in response to the tidal prism. Water surface elevations in the sloughs and restored ponds would be monitored to identify any drainage constraints caused by increases in the tidal prism.

Vegetation Colonization

Vegetation-elevation transects may~~would~~ be conducted within breached ponds to document rates and patterns of vegetation colonization in the new tidal marsh. For comparison, similar data may~~would~~ be collected for a natural reference marsh. Aerial photographs would aid in the documentation of vegetation colonization throughout an entire breached pond.

Introduced Vegetation

Vegetation surveys would also include monitoring for introduced species of cordgrass (*Spartina* spp.). The project team would work with the San Francisco Estuary Invasive Spartina Project to monitor and control introduced species of cordgrass, to ensure regional coordination and use of effective eradication techniques.

2.7.3.2 Wildlife Monitoring in Managed Ponds and Restored Tidal Habitats

Integrated Wildlife-Usage Surveys

Baseline, construction, and postconstruction macroinvertebrate, fisheries, and avian usage data would be collected at locations within restored and managed ponds to assess the impacts of the restoration upon the wildlife. The baseline condition would incorporate data collected by USGS during 1999 and 2000 (Takekawa et al. 2001). All surveys would be conducted within Universal Transverse Mercator (UTM) grids overlaid on the ponds. Results from initial

waterbird surveys would be used to select a subsample of grids, based on bird presence (random grids would be selected if bird use is not evident), for further survey each quarter. Analyses would examine both temporal and seasonal variation in pond usage.

Primary and Secondary Productivity

Water samples would be collected quarterly from each sample site within each pond for chlorophyll-a and nutrient (nitrogen and phosphorous) analyses. Chlorophyll-a concentration, a measure of algal community primary productivity, would be determined using spectrophotometry (Wetzel and Likens 1991). Nutrient concentration (soluble reactive phosphorous, total phosphorous, and nitrogen) would be determined using standard analytical methods (Clesceri et al. 1989). Zooplankton would be collected, preserved, and identified under a stereomicroscope (Pennak 1989).

Invertebrates

Invertebrates would be sampled in the water column using net sweeps and in the benthos with Eckmann grab samples. Sweep and grab samples would be taken monthly in each pond. Biomass (dry weight) and diversity of invertebrates would be measured on a seasonal basis.

Fish

Fish populations would be surveyed seasonally. Surveys would assess distribution and relative abundance of juvenile and adult fishes, with special emphasis on small species likely to occur in the study area (e.g., rainwater killifish [*Lucania parva*], topsmelt [*Altherinops affinis*], yellowfin goby [*Acanthogobius flavimanus*]) (Lewis Environmental Services and Wetland Research Associates 1992). Captured fish would be counted, identified to the species level, and subsequently released. A subset of the captured individuals of each species would be measured for standard length and weight. Relative weight (measured weight of an individual divided by a standard weight for the species), a measure of body condition, would be also calculated for these individuals (Wege and Anderson 1978; Anderson 1980). Stomach contents would also be collected and analyzed for a sample of individuals from selected species.

Waterbirds

Surveys would be conducted bimonthly following current USGS protocols (Takekawa et al. 2001). Locations of flocks would be mapped in a grid overlay and displayed in geographic information systems (GIS) maps. Usage trends would be examined by comparing data from before and after installation of water

control structures and/or restoration to tidal habitats. Water depth and foraging preferences would also be examined (Collazo et al., in review).

Contaminants

Invertebrate samples would be analyzed yearly for chemical residues to determine the level to which elemental contaminants such as mercury are being transferred to animals feeding on pond-dwelling macroinvertebrates. Net sweeps samples and grab samples of benthic invertebrates would be collected during the month of maximum bird use. Contaminant presence would be analyzed using standard laboratory techniques.

Introduced Predators

Nighttime spotlight surveys and track surveys would be conducted to monitor for the presence of introduced mammalian predators, particularly red fox, on the project site. Surveys would be focused on marshes containing populations of California clapper rails. When possible, nighttime predator surveys would include searches for fox dens and surveys of wildlife remains near fox dens. Track stations would be set up for the track surveys. Wildlife services staff from the U.S. Department of Agriculture would be hired to monitor for introduced mammalian predators, if staff are available.

2.7.4 Adaptive Management

Adaptive management is an approach to resource management in which management goals remain the same, but management objectives and techniques may be modified in response to feedback (such as monitoring results) from the system being managed. Adaptive management recognizes that human knowledge regarding biological and physical systems is limited and that these systems may not always behave as expected. When a management or restoration project is to be implemented but there is some uncertainty regarding the response of the system to particular actions, adaptive management provides a way for management actions to respond to feedback from the system being managed.

Adaptive management would be implemented if specific restoration standards are not met or if it appears that actual conditions would diverge far enough from intended conditions to threaten the achievement of overall project goals. Funding for adaptive management would be included in the project cost estimates so that this option would be available in the future if needed.

Should the development of the site fail to meet quantitative standards to be stated in the detailed monitoring plan, action would be undertaken to correct these shortfalls if such action could reasonably be expected to assist in the achievement of these standards. Corrective action could include vegetation management,

predator management, changes in the phasing of breaches, modifications to water control structures, or modifications to restoration design features.

Chapter 3
Hydrology

3.1 Environmental Setting

3.1.1 Introduction and Sources of Information

This chapter describes the hydrology in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Sources of data used in the preparation of this chapter include

- *the Bay Plan* (San Francisco Bay Conservation and Development Commission 2001*)*;
- *Report of the San Francisco Airport Science Panel* (National Oceanic and Atmospheric Administration 1999);
- *Evaluation of Ground Water Resources: Sonoma County* (California Department of Water Resources 1982);
- *Baylands Ecosystem Habitat Goals* (Goals Project 1999, 2000); and
- *CALFED Bay-Delta Program Final Programmatic Environmental Impact Report/Environmental Impact Statement* (CALFED Bay-Delta Program 2000).

3.1.2 Regulatory Setting

3.1.2.1 Federal Plans, Programs, and Policies

Rivers and Harbors Act

The Rivers and Harbors Act (RHA) of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. As defined by the RHA, navigable waters include all waters that are

- subject to the ebb and flow of tides and/or
- presently, historically, or potentially used for foreign or interstate commerce.

Regulations implementing Section 10 of the RHA are coordinated with those implementing CWA Section 404. Specifically, the RHA regulates

- construction of structures in, under, or over navigable waters;
- excavation or deposition of material in navigable waters; and
- all work affecting the course, location, condition, or capacity of navigable waters.

The RHA is administered by the Corps. If a proposed activity falls under the authority of both CWA Section 404 and RHA Section 10, the Corps processes and issues a single permit. For activities regulated only under RHA Section 10, such as installation of a structure not requiring fill, permit conditions may be added to protect water quality during construction.

Coastal Zone Management Act

The Coastal Zone Management Act of 1972 requires that federal actions be consistent with approved state coastal plans. BCDC's Bay Plan (Bay Plan) is an approved coastal plan under this act (see "McAteer-Petris Act" below for more information about this plan). ~~Therefore, after suitable coordination with BCDC, the Corps would prepare a determination that the project is consistent with the Bay Plan~~ The Corps is preparing a determination that the project is consistent with the Bay Plan concurrently with this EIS.

3.1.2.2 State Plans, Programs, and Policies

McAteer-Petris Act

The McAteer-Petris Act of 1965 established BCDC as a temporary state agency charged with preparing a plan for the long-term use of the bay (the Bay Plan). In August 1969, the McAteer-Petris Act was amended to make BCDC a permanent agency and to incorporate the policies of the Bay Plan into state law.

Under the McAteer-Petris Act and the Bay Plan, any person or agency proposing to place fill in, to extract materials from, or to make any substantial change in the use of any water, land, or structure in BCDC's jurisdiction in San Francisco Bay is required to secure a San Francisco Bay permit. BCDC grants San Francisco Bay permits for projects that meet either of the following qualifications:

- The project is necessary to the health, safety, or welfare of the public in the entire Bay Area.
- The project is consistent with the provisions of the Bay Plan and implementing regulations.

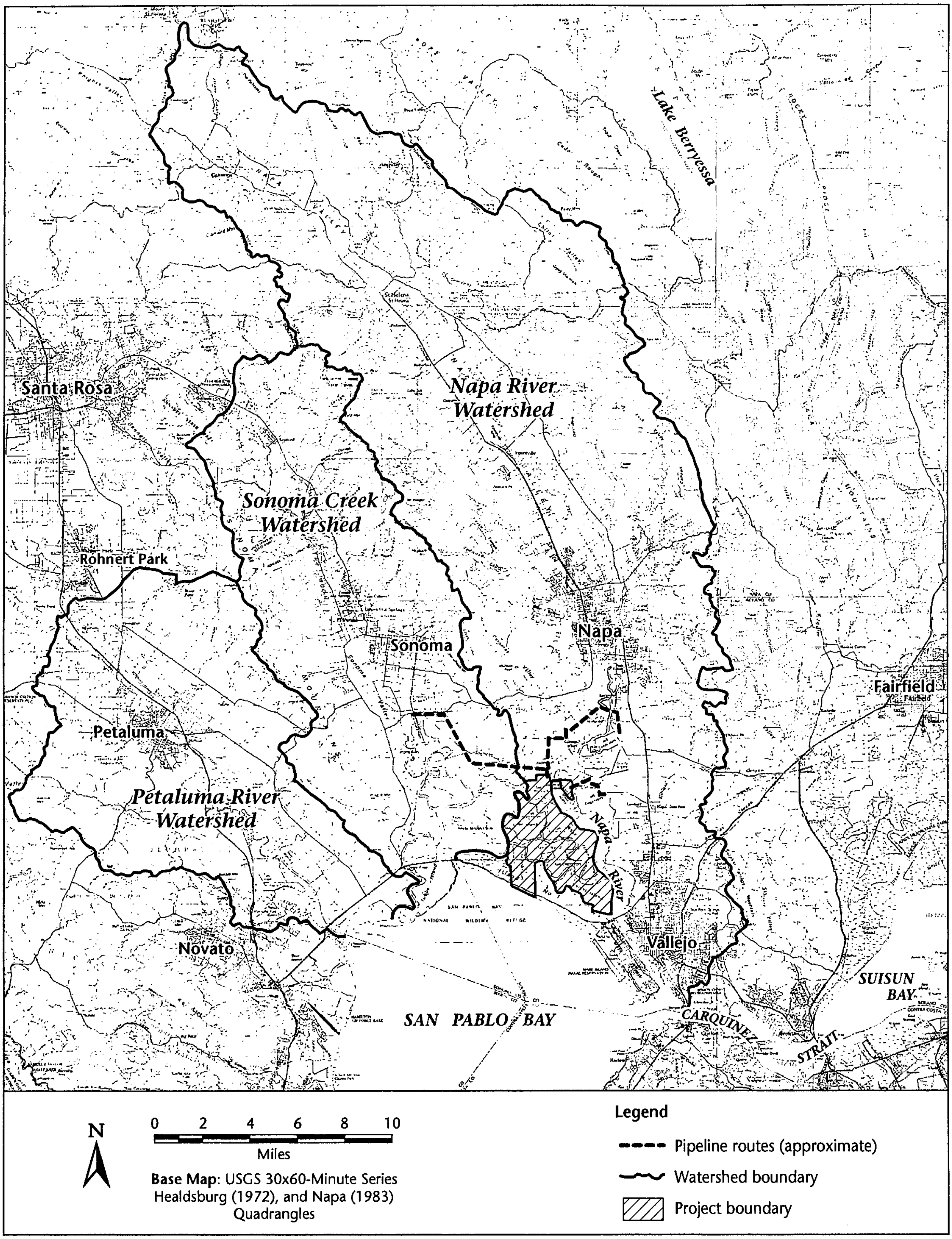


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Figure 3-1
Project Area Watershed

There are three types of San Francisco Bay permits: regionwide permit, administrative permit, and major permit. The type of permit issued depends on the scope and nature of the proposed activities. The project sponsors would prepare a major permit or conformity determination for the proposed project.

California Fish and Game Code Sections 1601–1607 (Lake or Streambed Alteration Agreement Program)

Pursuant to Sections 1601–1607 of the California Fish and Game Code, DFG regulates projects that affect the flow, channel, or banks of rivers, streams, and lakes. Sections 1601 and 1603 require public agencies and private individuals to notify and enter into a lake or streambed alteration agreement with DFG before beginning construction of a project that would

- divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake;
- use materials from a streambed; or
- result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake. Lake or streambed alteration agreements may impose conditions to protect water quality during construction.

Sections 1601–1607 may apply to any work undertaken within the 100-year floodplain of any body of water or its tributaries, including intermittent stream channels. In general, however, they are construed as applying to work within the active floodplain and/or associated riparian habitat of a wash, stream, or lake that provides benefit to fish and wildlife. Sections 1601–1607 typically do not apply to drainages that lack a defined bed and banks, such as swales, or to very small bodies of water and wetlands, such as vernal pools.

~~The project sponsors would prepare a lake or streambed alteration agreement for the proposed project.~~ DFG has determined that the restoration project area is not subject to Section 1600.

3.1.3 Regional Setting

3.1.3.1 Climate and Precipitation

The San Francisco Bay area, like much of California's central coast, experiences a Mediterranean climate characterized by mild, wet winters and warm summers. Moderated by proximity to the San Francisco Bay system and the ocean, temperatures are seldom below freezing. Summer weather is dominated by sea breezes caused by differential heating between the interior valleys and the coast, while winter weather is dominated by storms from the northern Pacific Ocean that produce nearly all the annual rainfall.

San Pablo Bay typically receives about 90% of its precipitation in the late fall and winter months (November–April); January has the greatest average rainfall. Average annual precipitation ranges from about 20 inches in San Pablo Bay to 40 inches in the upper watersheds of the region's major tributaries (Napa River and Sonoma Creek) (Rantz 1971).

3.1.3.2 Tides

San Francisco Bay experiences a mixed diurnal tide cycle, with two high tides and two low tides per day. Tide data relevant to the project area are collected by the National Oceanic and Atmospheric Administration (NOAA) in San Pablo Bay near the mouth of the Napa River and on the Napa River near Edgerley Island (next to Pond 8) and in the City of Napa (Table 3-1). The tidal data were collected relative to the mean lower low water datum, which has not been surveyed to the land-based data (NGVD 29 or NAVD 88).

Table 3-1. Elevations of Tidal Datum Referred to Mean Lower Low Water, in Feet

Tide	San Pablo Bay at Mare Island	Napa River at Edgerley Island	Napa River at Napa
Mean Higher High Water	5.73	6.30	6.66
Mean High Water	5.18	5.55	6.15
Mean Tide Level	3.05	3.20	3.54
Mean Low Water	0.93	0.86	0.94
Mean Lower Low Water	0.00	0.00	0.00

Source: National Oceanic and Atmospheric Administration 2001.

The tidal influences in the Napa River Unit from San Francisco Bay can be observed throughout the slough network with little or no muting by friction, which indicates that existing channels are large enough to allow full tidal exchange under existing conditions. Tidal flows are important because they contribute to channel shape and form through erosion and sedimentation.

3.1.3.3 Bay-Delta Estuary

The Bay-Delta estuary is the largest estuary on the West Coast of North and South America. It can be divided into three distinct component bays or "subestuaries": San Francisco Bay, San Pablo Bay, and Suisun Marsh (Figure 1-1). Located on the central coast of California, this estuary system occupies a natural topographic separation between the northern and southern coastal mountain ranges and functions as the only drainage outlet for waters of the Central Valley.

The Central Valley is drained by the Sacramento and San Joaquin Rivers, which enter San Pablo Bay and San Francisco Bay through the Delta at the eastern end of Suisun Bay. The Sacramento and San Joaquin Rivers contribute more than 95% of the estuary's freshwater inflow. Many smaller rivers and streams also convey fresh water to the Bay-Delta estuary.

The volume and timing of freshwater inflow are among the most important factors affecting physical, chemical, and biological conditions in the estuary. Freshwater input from the Delta peaks during the spring, when snow from the Sierra and other high mountain ranges of California melts. Input from smaller local tributaries, influenced by the region's Mediterranean climate, is strongly seasonal, with more than 90% of net annual runoff occurring during the winter (November–April) rainy season (Goals Project 1999).

In the north bay region, the principal groundwater-bearing aquifer is composed of alluvial deposits, which cover most of the valley areas in the Sonoma and Napa Valleys. These aquifers are largely continuous, with general flow toward San Pablo Bay. In the region adjacent to the bay, however, local flow has been reversed as a result of groundwater extraction, leading to saltwater intrusion. Groundwater levels in the alluvial deposits vary locally, but are generally 5–75 feet below the ground surface. In southern Sonoma County, local variations are observed because of the presence of local impermeable layers, which create small semiconfined aquifers. *Specific yield* is a measure of aquifer productivity, and is defined as the volume of water drained divided by the total volume of the sample. In alluvial deposits, the specific yield is moderate to high (8%–17%), which illustrates that the aquifer can produce substantial amounts of water.

The most significant natural recharge into alluvial aquifers occurs from rivers and streams. Generally, the alluvial deposits are not permeable enough to allow natural recharge from surface infiltration, although there is some limited recharge through surface infiltration resulting from precipitation.

As the land elevation ascends into the Huichica mountain range, the groundwater aquifer changes because volcanic deposits are present. The Huichica formation is composed of reworked volcanic sediments, with a low specific yield ranging from 3% to 7%. The low specific yield illustrates that this aquifer has lower productivity than alluvial deposits.

The Huichica formation produces limited amounts of groundwater, and the same soil conditions that limit productivity also limit recharge. The primary source of recharge is infiltration, usually through outcrops of the formation in the higher mountainous areas.

3.1.4 Project Setting

3.1.4.1 Surface Waters

San Pablo Bay

San Pablo Bay is a shallow bay strongly influenced by runoff from the Sacramento and San Joaquin Rivers. Natural runoff from tributaries directly into San Pablo Bay is highly variable. The upper elevations of the tributary watersheds are low enough to preclude any significant snowpack in most years, so there is no significant snowmelt runoff. In addition, permeability of soils and bedrock is generally low in the Coast Ranges. Thus, infiltration rates are slow and runoff rates are high, and the majority of the area's runoff occurs during and shortly after rainfall events. Consequently, tributary base flow is poorly sustained; runoff volume and streamflow depend almost entirely on total precipitation, which is variable from year to year.

This variability has important implications for the behavior of all San Francisco Bay Area streams including the Napa River and Sonoma Creek, which drain to San Pablo Bay on either side of the project area (Figure 3-1). Many smaller tributary streams are naturally dry during the summer, particularly in basins that receive less than 35 inches of precipitation annually; in others, summer base flow is far less than winter peak flow. In addition, flows vary markedly between dry and wet years.

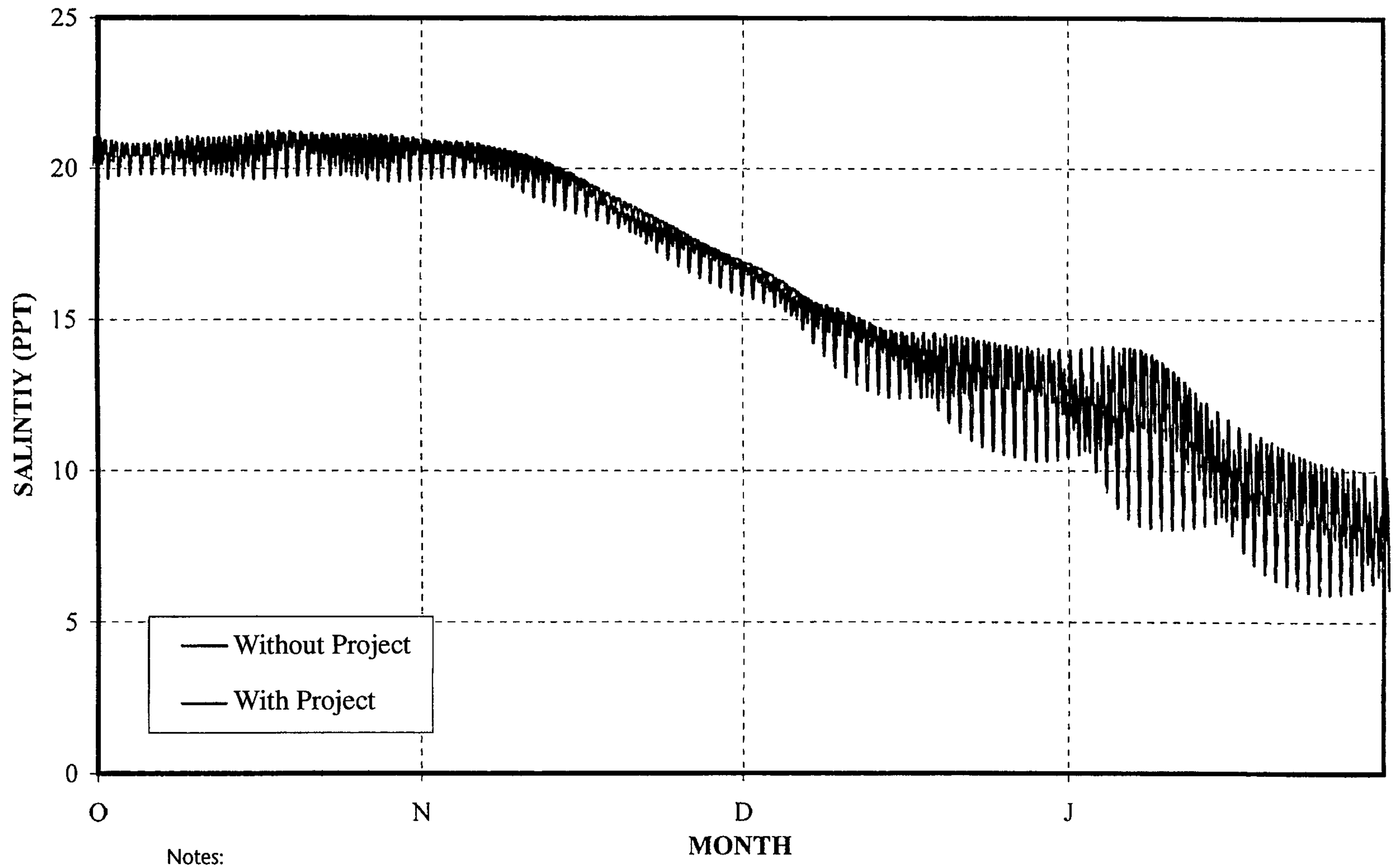
Napa River

The Napa River watershed encompasses approximately 425 square miles. The Napa River flows south through the Napa Valley approximately 40 miles from its headwaters on the southern slopes of Mt. St. Helena and the Mayacamas Mountains to its mouth in San Pablo Bay (Figure 3-1).

Flows from the Napa River vary markedly between dry and wet years. The long-term average discharge of the Napa River is approximately 66,000 af; however, the minimum recorded annual discharge (~5,000 af) occurred in 1931, and the maximum recorded annual discharge (in excess of 200,000 af) occurred in 1986 (U.S. Geological Survey 2001).

Sonoma Creek

The Sonoma Creek watershed encompasses approximately 160 square miles. The watershed is commonly divided into three subbasins: Fowler Creek and the smaller creeks west of Sonoma; Nathanson Creek and the creeks east of Schellville; and the mainstem of Sonoma Creek. The headwaters of the western tributaries lie in the Sonoma Mountains; most of the small creeks are collected by Fowler Creek, which eventually drains to Sonoma Creek near the town of



Notes:
Salinity in Napa River as simulated by MIKE 11.
Data extracted from Napa River near Pond 3 Outlet.
Values are sectionally averaged.
Simulated project-related impacts are less than seasonal variation.

Source: Philip Williams Associates 2002

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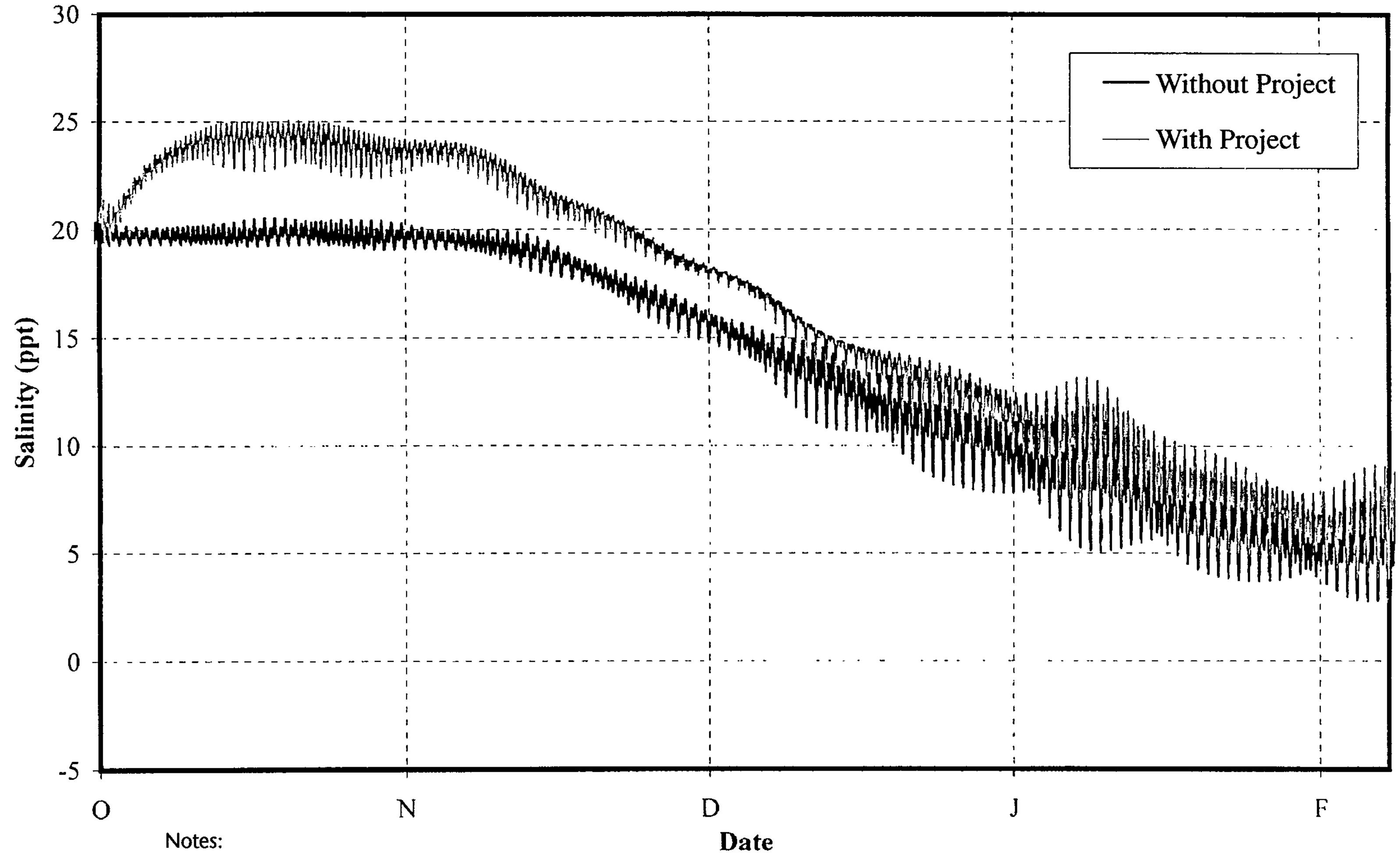
Figure 4-6
Salinity Reduction Option 1A – Salinity in Napa River near Pond 3 Outlet



Notes:
Salinity in Napa River as simulated by MIKE 11.
Data extracted from Napa River near Pond 4 Outlet.
Values are sectionally averaged.
Simulated project-related impacts are highest during the first 2–3 months of the project and decrease as Pond 4 salinity approaches ambient levels.
Initial Pond 4 Salinity of 111 ppt.

Source: Philip Williams Associates 2002

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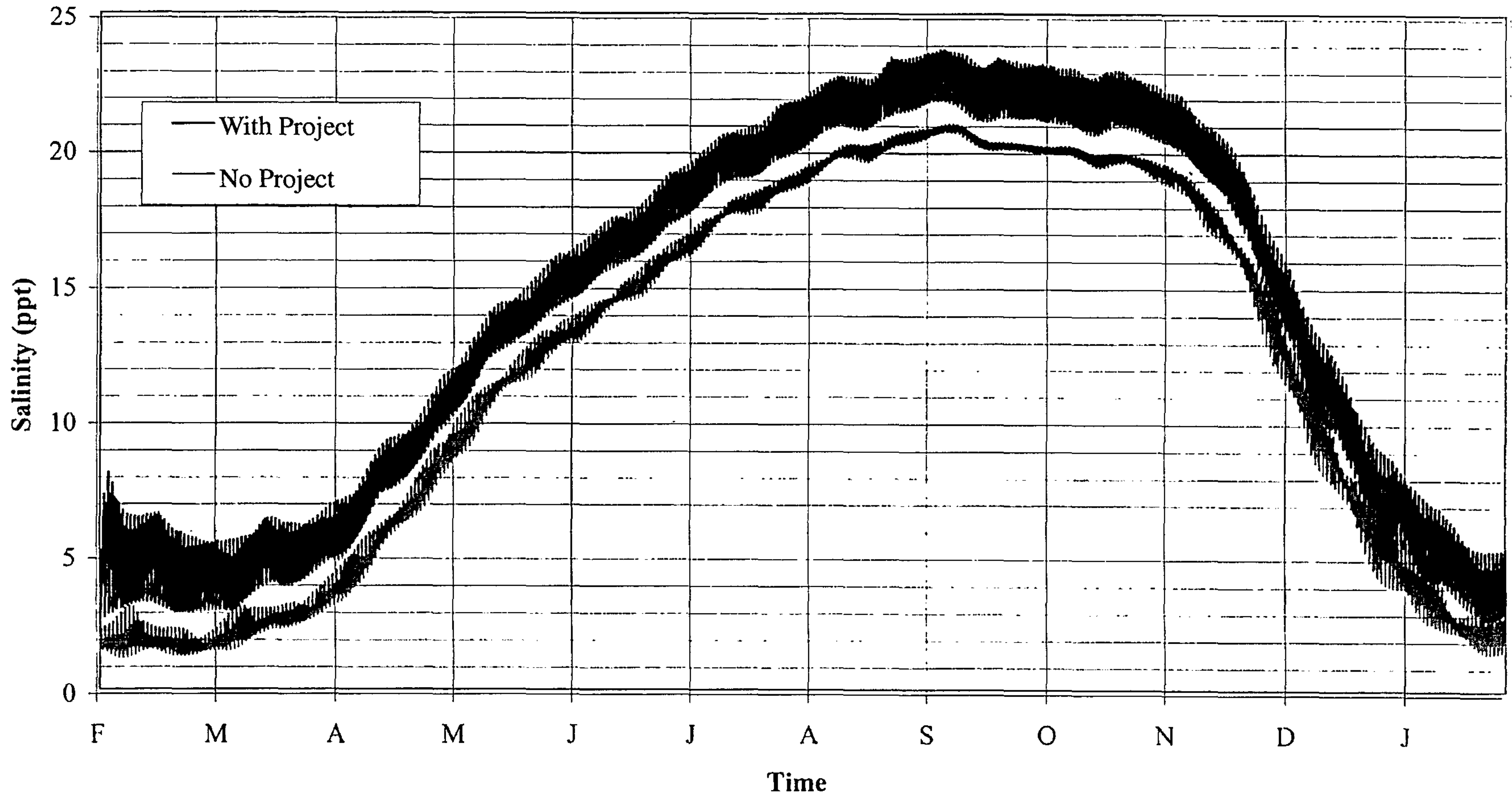
Figure 4-7
Salinity Reduction Option 1B – Salinity in Napa River near Pond 4 Outlet



Notes:
All data from 0k simulation of Upper Ponds under Salinity Reduction Option 1.
Values are sectionally averaged.

Source: Philip Williams Associates 2002

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Figure 4-8
Salinity Reduction Option 1 – Salinity in Napa Slough near Outlet from Pond 7, 7A, and 8

Sonoma. The eastern tributaries drain the hills to the north and east of Sonoma and join Schell Creek just south of town. Schell Creek flows for 5 miles before entering a network of channels and sloughs that interconnect with Sonoma Creek (Figure 3-1).

Sonoma Creek flows into San Pablo Bay via a number of circular sloughs and channels that have been highly modified over the last 150 years by dredging, levees, and realignment.

Flows from Sonoma Creek also vary markedly between dry and wet years. The long-term average discharge of Sonoma Creek is approximately 43,000 af; however, the minimum recorded annual discharge (~3,000 af) occurred in 1939, and the maximum recorded annual discharge (in excess of 115,000 af) occurred in 1956 (U.S. Geological Survey 2001).

Petaluma River

The Petaluma River watershed includes approximately 146 square miles and is 19 miles long. The upper 7 miles are upland in mountainous or hilly terrain, and the lower 12 miles are in an estuary area known as the Petaluma Marsh. The river starts upstream of the city of Petaluma and is used to transport commercial goods to and from Petaluma. The headwaters of the river are on the southwest slope of Sonoma Mountain, the southern slope of Mecham Hill, and the eastern slopes of Weigand's Hill and Mt. Burdell.

The Corps began dredging the Petaluma River for navigation in 1880, when it widened the existing creek to 50 feet wide and 3 feet deep at high tide. The Corps continued making the creek wider and deeper to allow additional navigation, and Congress declared the creek a river in 1959. High rates of siltation require the Corps to dredge the river regularly, with the San Pablo Bay channel being dredged on a 12-year cycle and the upper river channel being dredged on a 4-year cycle. (Southern Sonoma County Resource Conservation District 1999.)

Schell Slough

Schell Slough is a small waterway that flows into San Pablo Bay via several other sloughs, including Steamboat Slough, Third Napa Slough, Second Napa Slough, and Sonoma Creek. Wastewater from SVCSD is discharged into Schell Slough during the winter months.

Huichica Creek

Huichica Creek is an ephemeral stream that flows from the grasslands north of the project area. The creek is diverted in several locations into detention reservoirs for later use in vineyards. It terminates at Hudeman Slough.

Hudeman Slough

Hudeman Slough is a small waterway that flows into San Pablo Bay via Second Napa Slough. SVCSD discharges into Ringstrom Bay and the Hudeman Slough Mitigation Units, which drain into Hudeman Slough and other unnamed tributaries to San Pablo Bay. Treated wastewater from SVCSD is discharged during the winter months, but SVCSD has a zero-discharge limit from May through the end of October. During the "non-discharge" season (May through the end of October), SVCSD still discharges to Ringstrom Bay and the Hudeman Slough Mitigation Units (as required by permit conditions); however, the conveyances to the sloughs are closed. SCWA, which runs the WWTP ~~plant~~, has created a mitigation and enhancement wetlands project on the site of Hudeman Slough. SCWA's objective is to restore freshwater and muted tidal marshes, and it uses recycled water to aid in the restoration effort. (Camp Dresser and McKee 2000.)

Suscol Creek

Suscol Creek is an intermittent stream that flows into the Napa River immediately north of the Suscol WWTP.

Salt Ponds

The creation and operation of the salt ponds is described in detail in Chapter 2, "Site Description and Alternatives." In general, hydrology in the ponds is driven by operation of the facilities and precipitation. There is a net evaporative loss of water from the ponds, which was important in the salt-production process. The net evaporative loss typically ranges from 22 to 23 inches per year (Philip Williams and Associates 2002a). Bed elevations were measured before the hydrologic modeling effort and are illustrated in Figure 2-3. Water levels vary based on the season and operational conditions of the water control structures, but were historically maintained by Cargill at 0.5–4.5 feet deep.

3.1.4.2 Groundwater

Section 3.1.3.3, "Bay-Delta Estuary," above, provides a general description of the principal groundwater-bearing aquifer in the north bay region.

Groundwater hydrology in the area of the currently proposed pipelines for the Water Delivery Option (i.e., near the pipelines from the Sonoma and Napa WWTPs) is characterized by alluvial deposits with moderate to high productivity. Less than 0.5 mile north of the Sonoma Pipeline, the terrain starts to rise and the dominant groundwater feature becomes the Huichica formation. The Napa Pipeline travels along the border of the alluvial deposits (southeast of the pipeline) and the Huichica formation (northwest of the pipeline). South of the Sonoma and Napa Pipelines and for the length of the CAC Pipeline, the

alluvial deposits are covered with a layer of Bay Mud. Bay Mud deposits typically contain brackish or saline water, which has the potential to influence the alluvial deposits underneath.

In the area surrounding the Sonoma and Napa Pipelines, the domestic and agricultural water use is split between surface water and groundwater. Along the CAC Pipeline, a limited amount of groundwater is pumped for domestic uses because this area receives treated drinking water from the City of American Canyon. The surrounding agricultural areas depend on a mix of surface water and groundwater.

3.1.4.3 Geomorphology

The geomorphology of stream and slough channels in the project area reflects a long history of reclamation and water management. The major historical sloughs in the Napa River Unit remain intact, as reclamation occurred along these channels to minimize the amount of effort to convert the land from marsh to grazing land, but additional marsh has evolved as the hydrology of the slough system was altered.

3.1.5 Analysis Conducted for This Project

PWA has conducted extensive modeling of the proposed project area as part of Phase 1 of the hydrodynamic and geomorphologic analysis. One document recently released entitled *Hydrodynamic Modeling Analysis of Existing Conditions* (Philip Williams and Associates 2002a) was prepared to characterize the baseline or existing hydrodynamic conditions and construct a hydrodynamic model to simulate these conditions. In addition, geomorphic interpretation of the response of slough channels to the tidal restoration of the marsh system was investigated.

The existing physical conditions analysis included parameters such as water surface elevation and salinity, and sediment transport, using a combination of one- and two-dimensional computational modeling. One-dimensional (1-D) computational modeling is used to describe the predominantly 1-D flow through the network of slough channels and rivers (the Napa River and Sonoma Creek), and two-dimensional (2-D) computational modeling is used to describe the predominantly 2-D mixing processes in the former salt ponds. This study is closely connected to other recent projects upon which this study draws information:

- The investigation of the USGS and UCD, to collect velocity, salinity, depth, suspended sediment concentration, and temperature data at a series of 17 monitoring locations in the slough channels and rivers across the site between September 1997 and March 1998 (Warner 2000). These data were used to provide boundary data for the existing conditions model and for calibration and validation purposes of the 1-D computational model of the

slough channels and rivers that extend across the site of the former salt ponds.

- The contract undertaken by Towill, Inc., of San Francisco to produce a Digital Terrain Model (DTM) of the slough channels, rivers, salt ponds, and marsh plains of the site using a combination of topographical and bathymetrical surveying, aerial photography, and photogrammetry (Towill 2001). The DTM was used by PWA to construct the geometrical information required for the hydrodynamic model.
- The contract undertaken by PWA to physically measure the stage-discharge relationships for a selection of siphon water conveyance structures connecting the former salt ponds (Philip Williams and Associates 2002a). This information was used to characterize and identify the flow through the siphons to supplement theoretical discharge relationships that have been developed as part of the 2-D modeling of the former salt ponds.
- *Napa-Sonoma Marsh Restoration Project Phase I and Phase II Feasibility Studies for the Napa River, California* (Philip Williams and Associates 2002a, b, and c). These reports identified issues associated with the influence of the proposed restoration of Skaggs Island and Cullinan Ranch, technical issues identified by the MTAG, and restoration option modeling and analysis.
- PWA and DHI Water and Environment's additional 2-dimensional modeling of Pond 4 and the Upper Ponds in May 2003 with follow-up field sampling conducted in the fall of 2003 (DHI Water and Environment 2003).

3.2 Environmental Impacts and Mitigation Measures

3.2.1 Methodology and Significance Criteria

Criteria based on professional judgment and the State CEQA Guidelines were used to determine the significance of hydrology impacts. The project would have a significant impact on hydrology if it would

- substantially alter existing drainage patterns;
- substantially alter groundwater recharge patterns; or
- increase the risk of substantial property loss, injury, or death as a result of flooding.

The State CEQA Guidelines also state that a project would have a significant impact if it would

- substantially increase runoff, resulting in flooding on-site or off-site;

- create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems; or
- place within a 100-year flood hazard area structures that would impede or redirect floodflows.

The project or options would not affect runoff or stormwater infrastructure, or be an impediment to floodflows. Additionally, these criteria are intended for evaluation of development of urban land uses and do not apply to the proposed project.

3.2.2 No-Project Alternative

DFG would continue to manage water in the salt ponds as it does today. Water is pumped, as funding allows, directly from the Napa River (via the Pond 8 intake) and from San Pablo Bay (via the Pond 1 intake) to manage salinity in the ponds for wildlife habitat. ~~No~~Limited water is released back to the slough system via Pond 2, and there are currently no releases back to the Napa River~~,~~ or San Pablo Bay~~ (from the north side of Pond 1)~~. Although some water may percolate to groundwater, the vast majority is lost to evaporation. Continued operations under the existing regime would not alter drainage or recharge patterns, increase runoff, or contribute runoff that would exceed the capacity of the existing stormwater system. Therefore, there would be no impact on hydrology. No mitigation is required.

DFG would also continue to maintain the flood protection infrastructure. The levee system is in various states of disrepair. Levees are constructed of native bay muds dredged from the sloughs or the insides of the islands and were not intended or ~~are not~~ engineered for flood protection purposes. The levee system does not provide 100-year flood protection. While flooding may occur in the area, continued operations under the existing maintenance regime would not substantially increase the risk of property loss, injury, or death. Therefore, there would be no impact on flooding. No mitigation is required.

3.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

3.2.3.1 Beneficial Impact H-1: Reduced Risk of Property Damage, Injury, or Death as a Result of Flooding

The existing levee system is in various states of disrepair (Figure 2-2). If the weak sections in Pond 6A levee failed, Pond 6A would greatly increase the volume of the tidal prism that flows through adjacent sloughs. These increased flows would in turn lead to accelerated slough channel erosion, which could cause additional levee failures on either side of the slough channel. Levee failures along the western side of the project area would result in the inundation

of adjacent agricultural lands. The levee system would be repaired under this option, for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8, including the Pond 3 ditches, but not Ponds 3, 4, and 5, to facilitate salinity reduction, thus reducing the risk of failure. This impact is considered beneficial. No mitigation is required.

3.2.3.2 Impact H-2: Modification of Surface Drainage Patterns

Implementation of this option would result in minor changes in surface flow to and from the Napa River and sloughs. However, the change on a daily basis (approximately 70–500 cfs, depending on phase) is inconsequential when compared to the daily flow of the tidal prism of the lower Napa River and slough system (approximately 25,000 cfs). The 0.3–2% change is further minimized by the variability of freshwater flow of the Napa River. The changes in surface drainage patterns are small enough that they can be accommodated within the existing channels without an adverse effect. Therefore, this impact is considered less than significant. No mitigation is required.

3.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Beneficial Impact H-1 (except the Pond 3 ditches would not be repaired) and slightly more under Impact H-2. In addition, as described below under Impact H-3, there would be an increased risk of damage to adjacent properties.

3.2.4.1 Impact H-3: Increased Risk of Property Damage, Injury, or Death as a Result of Flooding

Breaching the levee system would open Pond 3 to substantial daily tidal flows that would result in periods of time when the ponds are deeper than under existing conditions. Increased depth may cause additional weakening on the internal sides of the remaining levee by increased wind and wave erosion and by daily wetting and drying of the levee materials.

A subsequent levee failure from one of the breached ponds to an adjacent slough (South, Devil's, Dutchman, or China Slough) would open an additional pathway for tidal flow that could result in channel erosion and could expose other levees to increased risk of failure. Although this sort of cascading levee failure would be generally consistent with the overall habitat restoration goals of the project site, adjacent properties such as Cullinan Ranch could also be affected. Therefore, this impact is considered significant. Implementation of Mitigation Measure H-1 would reduce this impact to a less-than-significant level.

Mitigation Measure H-1: Repair Unintended Levee Breaches

To prevent channel erosion and potential damage to adjacent levee systems, the project sponsors will repair unintended levee breaches that are not consistent with the restoration option selected for implementation.

3.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Beneficial Impact H-1 and Impact H-2) are nearly the same as those under Salinity Reduction Option 1B, though slightly greater. Impact H-3 is slightly different and is described below.

3.2.5.1 Impact H-3: Increased Risk of Property Damage, Injury, or Death as a Result of Flooding

The impact is nearly the same as that under Salinity Reduction Option 1B except that the severity of the impact would be somewhat greater because Pond 4/5 would also be opened for salinity reduction. This impact is considered significant. Implementation of mitigation measure H-1, "Repair Unintended Levee Breaches," would reduce this impact to a less-than-significant level.

3.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Beneficial Impact H-1 and Impact H-2) are nearly the same as those under Salinity Reduction Option 1A.

3.2.7 Water Delivery Option

This option would provide treated wastewater to increase the dilution rate of the saline waters stored in the ponds. It could be applied to any of the salinity reduction options discussed previously. The total annual flow would be ~~5~~6,000 – 7,000 af, which is ~~about 7.5~~between 9 and 10.6% of the average annual Napa River discharge.

3.2.7.1 Impact H-2: Modification of Surface Drainage Patterns

Water Delivery Project Component

Construction of the Sonoma, Napa, and CAC Pipelines could alter existing surface drainage patterns on a temporary and localized basis. Such alteration of drainage patterns would occur when sandbags, dikes, pumps, or other means are used to divert surface runoff around open-trench areas, pipe-jacking pits and receiving areas, and other such work areas. Such diversion generally would be short-term (typically 1–5 days) and limited to areas of active construction (i.e., pipeline construction segments would typically be about 200–300 feet long).

The Sonoma Pipeline route would cross Schell Slough, Huichica Creek, and two unnamed creeks as well as several smaller unnamed drainage ditches. Crossing of Schell Slough, Huichica Creek, and the two unnamed creeks (near where Ramal Road reaches the NWPRA railroad alignment and just west of Huichica Creek) would be accomplished using a jack-and-bore or other trenchless method whereby the pipeline is advanced beneath the subject stream and there is no alteration of the streamcourse or waters therein. At the smaller unnamed drainage ditches, trenching would be used for pipeline construction and, to the extent feasible, would be timed to avoid storm events/periods. It may be necessary on occasion, however, to employ short-term drainage diversion and control measures such as those described above. The pipeline route would also be within 400 feet of Hudeman Slough, but areas surrounding Hudeman Slough would be outside the limits of construction for the pipeline.

The Napa Pipeline route would cross under the Napa River, Suscol Creek, and several culverted drainage channels along county roadways. Crossing of the Napa River would be accomplished by directional drilling; crossing of Suscol Creek would use jack and bore or other trenchless methods. To cross the drainage canals, trenching would be used for pipeline construction and, to the extent feasible, would be timed to avoid storm events/periods.

The CAC Pipeline would cross the Napa River and would use an existing 24-inch transite and 16-inch rubber pipeline; hence, this surface watercourse would not be affected by pipeline construction.

In summary, implementation of the Water Delivery Project Component would result in short-term localized alterations of existing drainage patterns that would be limited to the time of construction activities. This impact does not represent a substantial alteration of existing drainage patterns.

This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the Water Delivery Program Component of the Water Delivery Option (i.e., potential future pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs). It is anticipated, however, that potential impacts on drainage patterns would be comparable to those described above for the Water Delivery Project Component, based on overall similarities in the nature of the subject improvements. Such similarities include the placement of pipeline primarily within existing roadways, railroad ROWs, and other improved corridors and the interest, from a regulatory standpoint, in using jack-and-bore or other trenchless methods to avoid direct crossings through rivers and major water bodies. Impacts on drainage patterns from implementation of the Water Delivery Program Component are anticipated to occur primarily from the temporary diversion of runoff around pipeline construction corridors and would be short-term and localized in nature.

It is anticipated that the impacts of the Water Delivery Program Component would be comparable to those of the Water Delivery Project Component; however, because the exact alignments and construction methods for the Program Component are uncertain, actual alteration of drainage patterns could be substantially different from and greater than assumed above.

This impact is considered significant. Implementation of Mitigation Measure H-2 would reduce this impact to a less-than-significant level.

Mitigation Measure H-2: Avoid Drainage Pattern Alteration in Plans for Future Pipeline Alignments

When the exact alignments and construction methods are determined for pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs, existing drainage patterns will be taken into consideration. Measures to avoid substantial alteration of the drainage patterns will be identified, evaluated, and applied as feasible and appropriate. Such measures may include, but not necessarily be limited to,

- placing pipeline in existing roadways and other such corridors with drainage improvements suitable for temporary rerouting of surface flows;
- avoiding placement and/or construction of pipeline in or through rivers, streams, or major drainage channels requiring substantial diversion or alteration of surface flows;
- avoiding any notable permanent alteration of drainage patterns;
- designing a construction program to enable pipeline advancement to occur in segment lengths that avoid extended periods of open trench and/or associated conditions requiring runoff diversion; and
- minimizing, if not avoiding, pipeline construction in major drainage areas during the rainy season (November–April).

3.2.7.2 Impact H-4: Alteration of Groundwater Supplies or Recharge Patterns

Water Delivery Project Component

Construction of the currently proposed pipelines may require dewatering during excavation for, and placement of, pipelines from the Sonoma, Napa, and CAC WWTPs. Similarly, excavation and use of pipeline jacking and receiving pits at the crossing of Huichica Creek, Napa River, and Suscol Creek may require temporary dewatering. These dewatering activities would be relatively short-term (approximately 5–10 days on average) and very localized. Such construction-related activities would not substantially deplete groundwater supplies nor would they alter groundwater recharge patterns.

Operation of the project would not result in any depletion of groundwater supplies and could, in the long term, contribute to the reduced use of local groundwater supplies for agricultural purposes. As the need for reclaimed water as part of the Napa River Salt Marsh Restoration Project diminishes over time, more reclaimed water would be available to agricultural operations along the pipeline routes. Those agricultural operations that rely on groundwater as a source of irrigation water would have an additional water source to offset and reduce the reliance on groundwater supplies. The project's potential to reduce depletion of groundwater supplies is considered a beneficial impact.

The project could alter recharge patterns, but with positive results by increasing recharge. Portions of land currently irrigated with groundwater instead would be irrigated with recycled water, which produces "in-lieu recharge." In-lieu recharge occurs when groundwater pumping is reduced, allowing natural mechanisms to recharge the groundwater without withdrawal. In addition to in-lieu recharge, there could be water from newly irrigated crops. Increased water availability could cause a crop shift from dry farming to irrigated farming, which could provide additional percolation from agricultural fields.

Overall, this impact is considered less than significant; in some respects, it may be beneficial. No mitigation is required.

Water Delivery Program Component

Although the exact alignments and construction methods have not yet been determined for the Water Delivery Program Component of the Water Delivery Option, the overall construction- and operations-related impacts of the Water Delivery Program Component would likely be comparable to those described above for the Water Delivery Project Component based on similarities in the basic nature and design of the pipelines. Implementation of the Water Delivery Program Component is not expected to substantially deplete groundwater supplies or substantially alter groundwater recharge patterns.

Overall, this impact is considered less than significant; in some respects, it may be beneficial. No mitigation is required.

3.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

3.2.8.1 Beneficial Impact H-2: Modification of Surface Drainage Patterns

Activities associated with habitat restoration, including the reestablishment of full tidal exchange, would result in long-term alteration of surface drainage patterns in the project area. Existing surface drainage patterns would largely be disrupted. However, human activities around the margins of San Pablo Bay during the past 150 years have substantially altered existing drainage patterns from their natural condition and function. After restoration, drainages would convey a much greater percentage of the historic~~the full amount of~~ runoff and tidal flow, representing a return to a more natural hydrologic condition and function. Consequently, this impact is considered beneficial. No mitigation is required.

3.2.8.2 Beneficial Impact H-5: Increased Flood Conveyance Capacity

Tidal channels on and adjacent to restored marshlands would be larger after restoration than under existing conditions, as a result of natural channel erosion, as areas adjacent to starter~~dredged~~ channel segments achieve dynamic equilibrium with adjusted channel form and invert elevation of modified channel reaches.

Consequently, flood conveyance capacity of major tidal channels would be increased, lowering flood risk on nearby parcels. This impact is considered beneficial. No mitigation is required.

3.2.8.3 Impact H-6: Continued Adjustment of Invert Elevation and Channel Form near Breached Channel Segments

Channel reaches adjacent to breaches made during construction would continue to adjust to the new increased tidal prism. Because existing channel gradients are gentle, and because breaching would not result in large changes in invert elevation or channel form, this effect would be minor and would be confined to the immediate vicinity of the project site. However, short-term channel incision would likely result in increased sediment suspension and water turbidity

downstream of areas where erosion is taking place. (These effects are described in more detail in Chapter 4, "Water Quality.") Appropriate site-specific design should ensure that this effect would be comparatively minor and that it would decrease and disappear as the system equilibrates as part of habitat restoration. This impact is considered less than significant. No mitigation is required.

3.2.8.4 Impact H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels

Where tidal connectivity is established by opening the former salt ponds to an existing tidal channel rather than creating a direct connection to San Pablo Bay or the Napa River, site development has the potential to increase flood risk on properties that surround the project site. Several factors influence the potential change in flood risk, including increased tidal prism (increased discharge) in existing tidal channels, and the design characteristics and tolerances of existing levees.

Reestablishing tidal connectivity initially would increase the average discharge in tidal channels. Increased discharge would increase the potential for erosion of levees as a result of tidal currents and for seepage and seepage-related failures as a result of increased hydraulic gradient attributable to erosion of slough side materials. The effects of increased discharge would be most pronounced immediately after tidal connectivity is reestablished and would moderate as restored marshlands aggrade and tidal prism decreases. The new equilibrium size of the South and Dutchman Slough channels needed to convey the new tidal prism would be substantially wider than the existing channels. Assuming that the channel would erode quickly and symmetrically along the centerline of the existing channel, the levees on both banks would be undercut. Because there would be an initial increase in the risk of property loss, particularly along South and Dutchman Sloughs, this impact is considered significant. Implementation of Mitigation Measure H-3 would reduce this impact to a less-than-significant level.

Mitigation Measure H-3: Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge

Additional hydraulic modeling is being conducted by the Coastal Conservancy and the Corps to identify channel reaches where channel or levee erosion is likely once tidal connectivity is restored as a result of project implementation (Philip Williams and Associates 2002c).

As part of the development of final project design, data from site-specific hydraulic modeling will be further evaluated to determine channel size and morphology, width of buffer zones, and levee improvements if necessary, to ensure that all channels are adequate for anticipated post-restoration discharge. Design refinements~~features~~ that have not yet been identified in the project

description, such as levee breach phasing or alternate levee breach locations, may be recommended.

Once the project is implemented, a monitoring and adaptive management plan will also be implemented to monitor the expansion of the slough channels to accommodate the additional tidal prism and to ensure that the expansion does not threaten the adjacent levee systems. If channel expansion threatens adjacent levees, a California-licensed civil engineer will evaluate the stability of the levee protecting adjacent properties and recommend measures to reduce erosion. T~~t~~he adaptive management team will select measures from these recommendations ~~measures~~ to protect the levee in question. These measures may include additional levee breaches, altering the phasing of pond levee breaching, or requiring levee repairs~~ or revetment~~.

3.2.8.5 Impact H-8: Potential Increase in Flood Risk on Adjacent Properties as a Result of Wave Erosion

Breaching and lowering selected portions of perimeter levees would connect restored marsh, creating larger, ~~potentially deeper~~interconnected areas of open water. The potential for increased flood risk is greatest in the larger and deeper ponds, Ponds 4, 5, and 6, though this flood risk is limited to properties west of Pond 6. Initially, breaches would remain comparatively small and the levees would provide barriers to wind-driven waves. Because the levees would no longer be maintained after tidal connectivity is reestablished, they would erode gradually, representing progressively less important barriers to wind-driven waves and allowing fetch across open waters at high tide to increase. As a result, wind-driven waves that affect adjacent levees may be larger after habitat restoration than under existing conditions.

Increased wave activity may increase the potential for levee damage and failure as a result of wave erosion, potentially increasing the risk of flooding on adjacent properties such as Skaggs Island and Cullinan Ranch. Increased wave erosion effects would moderate somewhat as the restored marshlands naturally aggrade; smaller waves would be generated and waves would shoal progressively farther from levees, and correspondingly more wave energy would be dissipated before impinging on the levees.

The severity of this effect would depend on the length of time it takes for the marsh plain to develop and the distance between the levee and open water to increase. Based on the accretion modeling done to date, this problem would be most likely to occur during the first 20 years of restoration in each pond. In the event of such an occurrence, nearby levees could be damaged.

This impact is considered significant. Implementation of Mitigation Measure H-4 would reduce this impact to a less-than-significant level.

Mitigation Measure H-4: Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed

The project sponsors will have a California-licensed civil engineer evaluate the stability of the levee system with respect to wind-driven wave erosion resulting from project implementation. If necessary, the civil engineer will recommend measures to reduce the risk of erosion. These measures may include monitoring and adding sacrificial soil material at the toe of the levee as needed, limiting fetch by installing in-pond barriers or deflectors, or repairing levees as needed.

3.2.8.6 Impact H-9: Potential Navigation Hazard as a Result of Increased Velocity in Mare Island Strait

Implementing the project will result in increased tidal prism that would flow through the relatively narrow Mare Island Strait. The increased volume of tidal water will result in an increased velocity in the shipping channel. The channel velocity may increase by up to 1 meter per second (1.9 Knots). It is not anticipated that this increase in velocity would have an adverse effect on pleasure boating as most small craft are very maneuverable and can greatly exceed the anticipated velocity. Larger ships are substantially less maneuverable and require large distances to alter course turn or slow. Generally, the arrival and departure of ships is scheduled to coincide with the tides. Ships arrive~~ing~~ with the flood tide and depart~~ing~~ on the ebb to maximize the depth of water under the keel and to minimize the tidal effects on maneuverability. Therefore, no mitigation is required. This impact is considered less than significant.

3.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts of Habitat Restoration Option 2 are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impacts H-2 and H-5 and Impacts H-6, H-8, and H-9. Impact H-7 is slightly different and is described below.

3.2.9.1 Impact H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels

This impact is nearly the same as that under Habitat Restoration Option 1 except that the severity of the impact would be somewhat greater under Habitat Restoration Option 2 than under Habitat Restoration Option 1. More area would be restored to tidal marsh in this option, increasing the total tidal prism. Because the total tidal prism that would have to be conveyed through the tidal slough

network would be greater, there would be more channel erosion to reach equilibrium. Therefore, the risk to adjacent levees would be somewhat greater than under Habitat Restoration Option 1. The threat to levees would still exist; therefore, this impact is considered significant. Implementation of Mitigation Measure H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," would reduce this impact to a less-than-significant level. This measure is described under Habitat Restoration Option 1.

3.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts of Habitat Restoration Option 3 are nearly the same as those under Habitat Restoration Options 1 and 2 for Beneficial Impacts H-2 and H-5 and Impacts H-6, H-8, and H-9. Impact H-7 is slightly different and is described below.

3.2.10.1 Impact H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels

This impact is nearly the same as described under Habitat Restoration Option 1 except that the severity of the impact would be somewhat less under Habitat Restoration Option 3. Much more area would be retained as managed pond in this option, reducing the total tidal prism compared to Habitat Restoration Option 1. Because the total tidal prism that would have to be conveyed through the tidal slough network would be less, there would be less channel erosion to reach equilibrium. Therefore, the risk to adjacent levees would be somewhat lower than under Habitat Restoration Option 1.

The threat to levees would still exist. Therefore, this impact is considered significant. Implementation of Mitigation Measure H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," would reduce this impact to a less-than-significant level. This measure is described under Habitat Restoration Option 1.

3.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts of Habitat Restoration Option 4 are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impacts H-2 and H-5, and Impacts H-6, H-8, and H-9. Impact H-7 is slightly different and is described below.

3.2.11.1 Impact H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels

This impact is nearly the same as described under Habitat Restoration Option 1 except that the severity of the impact would be somewhat less under Habitat Restoration Option 4 than under Habitat Restoration Option 1. Some fill would be used to reduce the total tidal prism and other measures would be implemented to maximize the marsh accretion rate (e.g., an increase in the number of starter channels and berms created). Because the total tidal prism that would have to be conveyed through the tidal slough network would be slightly less, there would be slightly less channel erosion to reach equilibrium. The risk to adjacent levees would be somewhat lower than under Habitat Restoration Option 1; therefore, the threat to levees would still exist.

This impact is considered significant. Implementation of Mitigation Measure H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," would reduce this impact to a less-than-significant level. This measure is described under Habitat Restoration Option 1.

Chapter 4
Water Quality

4.1 Environmental Setting

4.1.1 Introduction and Sources of Information

This chapter describes the physical and chemical environment of the Napa River Unit with respect to marsh sediments and water quality in the salt ponds and surrounding surface water bodies (Napa River and San Pablo Bay). Information on the existing conditions is derived from extensive water quality monitoring conducted by the USGS; UCD historical data records for the Napa River and San Pablo Bay; and recent sediment and water quality sampling conducted specifically for the project by Hydroscience Engineers. This chapter also describes the results of a hydrodynamic and water quality model developed for the restoration project by PWA.

Data regarding the quality of water currently discharged from the SVCSD, NSD, and CAC WWTPs (i.e., the Project Component of the Water Delivery Option discussed in Section 4.2.7) were provided by WWTP staff.

4.1.2 Regulatory Setting

Several state and federal agencies have regulatory authority or responsibility over project-related activities that affect water quality. Table 4-1 below summarizes project-related activities, the environmental resources potentially affected by each activity, and the government agency with regulatory authority over the activity.

Table 4-1. Summary of Regulatory Setting for Water Quality

Project-Related Activity	Regulatory Authority
Construction activities that could adversely affect water quality	RWQCB–NPDES stormwater permit (CWA Section 402); CWA Section 401 water quality certification
Operations of controlled levee breaches and/or physical structures (e.g., pumps, weirs, siphons) to facilitate flushing and dilution of salt ponds	RWQCB–NPDES individual permit and/or WDRs (Porter-Cologne Act and Basin Plan) for waste discharge to waters of the state; CWA Section 401 water quality certification

RWQCB = Regional Water Quality Control Board
NPDES = National Pollutant Discharge Elimination System
WDRs = waste discharge requirements
CWA = Clean Water Act
Basin Plan = *Water Quality Control Plan, San Francisco Bay Region*

4.1.2.1 Regional Water Quality Control Board Authority

The RWQCBs have primary authority for implementing provisions of the federal CWA and California's Porter-Cologne Water Quality Control Act. These statutes establish the process for developing and implementing planning, permitting, and enforcement authority for waste discharges to land and water. The *Water Quality Control Plan, San Francisco Bay Region* (Basin Plan) establishes beneficial uses for surface and groundwater resources and sets regulatory water quality objectives that are designed to protect those beneficial uses (San Francisco Bay RWQCB 1995). Under the current Basin Plan, designated beneficial uses of the San Francisco Bay area's surface waters include municipal and domestic supply; agricultural supply; industrial service supply; groundwater recharge; contact and noncontact recreation; warm freshwater fish habitat; cold freshwater fish habitat; wildlife habitat; migration of aquatic organisms; and spawning, reproduction, and/or early development of fish. Beneficial uses of San Francisco Bay area groundwater include municipal and domestic supply, agricultural supply, and industrial service supply.

The Basin Plan establishes numeric and narrative surface and groundwater water quality objectives designed to protect designated beneficial uses of surface water and groundwater resources. Other applicable water quality criteria include the California Toxics Rule (CTR), which establishes numeric criteria for aquatic life and human health protection for approximately 130 priority trace metal and organic constituents. Numeric water quality objectives include specific concentration-based values that may be imposed on the effluent or at the edge of an allowable mixing zone within the receiving water. Numeric Basin Plan and CTR criteria differ depending on the salinity content.

The Basin Plan defines fresh water, saltwater, and estuarine waters as follows: Fresh water has a salinity of less than 5 ppt more than 75% of the time; saltwater has a salinity of more than 5 ppt more than 75% of the time; and estuarine water has a salinity that is between that of fresh water and saltwater. In general, the lower of the saltwater or fresh water quality criteria apply to estuarine conditions.

The San Francisco Bay RWQCB applies estuarine water quality criteria to San Pablo Bay and the Napa River. Narrative criteria provide general guidance to avoid adverse water quality impacts for constituents including salinity, sediment (i.e., total suspended solids [TSS]), tastes and odors, sulfides, toxicity, and bioaccumulation. Numeric criteria included in the Basin Plan include such parameters as trace metals, dissolved oxygen, turbidity, temperature, pH, bacteriological pathogens, and un-ionized ammonia. Table 4-2 shows selected surface water quality objectives of potential concern for tidal wetland restoration projects and applicable numeric and narrative criteria.

Table 4-2. Surface Water Quality Objectives for Potential Constituents of Concern

Constituent	Units	Water Quality Objective *
Temperature	°F	Controllable water quality factors shall not increase temperature by more than 5°F.
Dissolved oxygen	mg/l	5.0 mg/l. Minimum dissolved oxygen is applicable to tidal waters downstream of Carquinez Bridge. The median dissolved oxygen concentration for any 3 consecutive months shall not be less than 80% of the dissolved oxygen content at saturation.
Salinity	ppt	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
pH	standard units	6.5 to 8.5. The pH shall not be depressed below 6.5 or raised above 8.5. This range encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes of greater than 0.5 unit in normal ambient pH levels.
Turbidity	NTU	Waters shall be free of changes in turbidity that could cause nuisance or adversely affect beneficial uses. Increases of turbidity as a result of waste discharge shall not be greater than 10% in areas where natural turbidity is greater than 50 NTU.
Sediment	mg/l	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Sulfide	mg/l	All water shall be free of dissolved sulfide concentrations above natural background levels. Sulfide occurs in bay muds as a result of bacterial action on organic matter in an anaerobic environment.
Toxicity	NA	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90% survival, or less than 70% survival more than 10% of the time, of test organisms in a 96-hour static or continuous flow test.
		There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

(continued next page)

Table 4-2. Continued

Constituent	Units	Water Quality Objective [1]
Bioaccumulation	NA	Many pollutants can accumulate on particles or in sediment or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.
Arsenic	µg/l	36^{S}, 150^{F}
Cadmium	µg/l	9.3^{S}, 1.1^{F}
Chromium, total	µg/l	180^{F}
Chromium, hexavalent	µg/l	50^{S}, 11^{F}
Copper	µg/l	3.1^{S}, 9.0^{F}
Lead	µg/l	5.6^{S}, 2.5^{F}
Nickel	µg/l	7.1~~8.2~~ ^{S}, 5.2^{F}
Silver [2]	µg/l	1.9^{S}, 3.4^{F}
Selenium	µg/l	7.1^{S}, 5.0^{F}
Mercury	µg/l	0.025^{S}, 0.025^{F}
Zinc	µg/l	81^{S}, 23^{F}
PCBs, total [3]	µg/l	0.000170^{S}, 0.000170^{F}

[1] Narrative objectives are used where numeric objectives have not been established. Unless noted otherwise, single numeric values represent the chronic exposure (4-day average) concentration not to be exceeded at a frequency exceeding once every 3 years. Trace metal criteria represent the lower of the Basin Plan objectives or California Toxics Rule (CTR) for saltwater (S) or freshwater (F) conditions.

[2] Criteria applicable to acute exposure concentration only (instantaneous maximum).

[3] CTR human health criteria for consumption of organisms.

Notes:

mg/l = milligrams per liter
µg/l = micrograms per liter
ppt = parts per thousand
NTU = nephelometric turbidity units
NA = not applicable
PCBs = polychlorinated biphenyl compounds

Disposal Option Sediment Screening Criteria

The San Francisco Bay RWQCB also established sediment screening criteria and testing requirements for the beneficial reuse of dredged material (e.g., wetlands creation and upland disposal). The criteria are intended to facilitate the creation, enhancement, and restoration of wetlands in marine and estuarine environments. The criteria were developed in part based on Effects Range–Low (ER-L) and Effects Range–Median (ER-M) criteria originally developed by NOAA (California Department of Water Resources 1995). The ER-L criteria reflect the concentration below which adverse biological effects may be expected to occur less than 10% of the time. ER-M criteria reflect the concentration below which adverse biological effects may be expected to occur less than 50% of the time.

The RWQCB criteria specify the allowable use based on two categories: use for wetland noncover where exposure to the aquatic environment would be limited and wetland cover or levee construction where sediments would be exposed to the water. Table 4-3 shows the applicable criteria for trace metals and organic compounds.

Table 4-3. RWQCB Disposal Option Sediment Screening Criteria

	Criteria	
Constituent	Wetlands Creation Noncover (mg/kg, dry weight)	Wetlands Creation Cover and Levee Restoration (mg/kg, dry weight)
Arsenic	33–85	<33
Cadmium	5–9	<5
Chromium, total	220–300	<220
Copper	90–390	<90
Lead	50–110	<50
Nickel	140–200	<140
Mercury	0.35–1.3	<0.35
Selenium	0.7–1.4	<0.7
Silver	1.0–2.2	<1.0
Zinc	160–270	<160
PAHs, total	4–35	<4
DDT	0.003–0.1	<0.003
PCBs, total	0.05—0.4	<0.05

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon

4.1.2.2 CWA Section 402 and RWQCB Permitting Procedures

Section 402 of the CWA prohibits the discharge of all pollution into surface waters unless permitted under the National Pollutant Discharge Elimination System (NPDES), which is administered by the U.S. Environmental Protection Agency (EPA), or by a state agency with a federally approved control program. In California, Section 402 authority has been delegated to the SWRCB and is administered by RWQCBs.

To ensure conformance with the Basin Plan and the federal CWA, the RWQCB issues WDR and/or NPDES permits to projects that may discharge wastes to land or water. The federal NPDES permit system includes procedures for point-source waste discharges and stormwater discharges. It is anticipated that the San Francisco Bay RWQCB would ~~not~~ impose WDRs on the discharge of bittern and an NPDES point-source discharge permit on the discharge of recycled water

although~~proposed project because~~ the project is considered a long-term beneficial water reclamation and wetland restoration project. ~~However, t~~The RWQCB administers the statewide general NPDES stormwater permit for general construction activity that applies to projects that disturb more than 5 acres of land; this permit will most likely be required. The NPDES permit requires filing with the San Francisco Bay RWQCB a public notice of intent (NOI) to discharge stormwater and preparation and implementation of a stormwater pollution prevention plan (SWPPP). The SWPPP must include a site map and description of construction activities and identify BMPs that would be employed to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate receiving waters. Monitoring may be required to ensure that BMPs are implemented according to the SWPPP and are effective at controlling discharges of stormwater-related pollutants.

Erosion and sediment delivery to the Napa River would be minimized during project construction. Related efforts would include measures to minimize the potential for sediment to enter the river as well as interim measures to stabilize soil pending establishment of vegetative cover. As part of the SWPPP required for project construction, an erosion and sediment control plan would be prepared and incorporated into project construction plans and specifications. More specifically, for stormwater discharges from construction sites, SWRCB Order 99-08-DWQ authorizes NPDES general permit No. CAS000002, Waste Discharge Requirements for Discharge of Storm Water Runoff Associated with Construction Activity. The San Francisco Bay RWQCB implements the provisions of general permit CAS000002 and may issue an individual NPDES permit and waste discharge requirements for construction activities or projects found ineligible for coverage under the general permit. The selected contractor(s) would be responsible for implementing the erosion and sediment control plan under DFG or Corps supervision, as required by the permitting process of the NPDES.

If a general permit application for either stormwater or groundwater extraction is found ineligible for permitting under the limitations and requirements of a general permit, the San Francisco Bay RWQCB may consider authorizing a single individual permit incorporating provisions applicable to both stormwater and groundwater extraction activities.

4.1.2.3 CWA Section 401—Water Quality Certification

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated

to the State Water Resources Control Board (SWRCB) and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States.

For purposes of this project, DFG and the Corps will obtain certification from the San Francisco Bay RWQCB under Section 401.

4.1.2.4 CWA Section 303(d)—Water Quality Limited Water Bodies

Under CWA Section 303(d), the RWQCB and SWRCB list water bodies as impaired when not in compliance with designated water quality objectives and standards. A total maximum daily load (TMDL) program must be prepared for waters identified by the state as impaired. A TMDL is a quantitative assessment of a problem that affects water quality. The problem can include the presence of a pollutant, such as a heavy metal or a pesticide, or a change in the physical property of the water, such as DO or temperature. A TMDL specifies the allowable load of pollutants from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to individual pollutant sources.

The Napa River is currently identified on the EPA Section 303(d) list for the state as being impaired by nutrients, pathogens, and sedimentation. TMDL programs are planned for these constituents with projected completion by 2005. The identified sources of the contaminants include a full range of agriculture, urban runoff, resource extraction, atmospheric deposition, and natural sources.

Sonoma and Petaluma Creeks are included on the 303(d) list because of high levels of nutrients, pathogens, and sedimentation from agriculture, development, and urban runoff. Both TMDL processes are scheduled for completion in 2005. Novato Creek is on the 303(d) list for diazinon contamination (as are all San Francisco Bay urban creeks) because of urban runoff; the TMDL process is scheduled for completion by 2004.

San Pablo Bay is listed as impaired for several organochlorine pesticides, the organophosphorus pesticide diazinon, dioxin and furan compounds, polychlorinated biphenyl (PCB) compounds, copper, mercury, nickel, and selenium. Development of the TMDL for mercury in the greater San Francisco Bay is currently underway. North San Francisco Bay, including San Pablo Bay, is being evaluated to determine whether impairment by copper is actually a problem. As a result of this effort, San Pablo Bay may eventually be delisted for copper. The TMDLs that will be required for San Pablo Bay are in various states of development and are projected for completion in 2010. A mercury TMDL

report has been completed that describes the problem conditions and assessment of sources (San Francisco Bay RWQCB 2000).

4.1.2.5 Section 313

Section 313 of the CWA (33 USC 1323) states:

> ...each department, agency, or instrumentality of the executive, legislative, and judicial branches of the federal government having jurisdiction over any property or facility, or engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants...shall be subject to, and comply with, all federal, state, interstate and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution in the same manner, and to the same extent as any nongovernmental entity.

The Corps would comply with Section 313 of the CWA by complying with Sections 404, 401, and 402 of the CWA, California Fish and Game Code Section 1600, and regional and local requirements of the San Francisco Bay RWQCB and SWRCB through the Basin Plan and NPDES permitting. A Corps project does not need a Section 404 permit; instead, the Corps conducts an equivalent evaluation in-house. This Section 404(b)(1) evaluation is described in Appendix B. The Corps would consider and mitigate changes in habitat, salinity, and other water quality parameters through project modification and, if necessary, mitigation. In multiple locations, DFG has determined that the restoration project area is not subject to Section 1600 because it is in a tidal zone. Section 313 of the CWA applies only to federal agencies.

4.1.2.6 Water Recycling Law

Chapter 7 of the California Water Code, also known as the Water Recycling Law, establishes the intent of the legislature to encourage water recycling as a method to increase the ability to meet the growing water needs within California. The law authorized the SWRCB to loan money to local agencies to develop water reclamation facilities and directed the state Department of Health Services (DHS) to create water recycling criteria. In addition, it developed reporting requirements and established permitting procedures for the regional boards in conjunction with DHS.

4.1.2.7 Title 22, California Code of Regulations Criteria for Recycled Water Quality

DHS holds the authority to set criteria for recycled water production and use. Title 22, Division 4 of the California Code of Regulations (CCR) defines these criteria, which pertain to treatment processes, water quality, and reliability. Title 22 establishes minimum water quality criteria requirements for various use categories, including irrigation, wetlands, and industrial uses. Table 4-4 lists the

treatment levels required for different uses of reclaimed water that are possible within the north bay region.

Table 4-4. Water Treatment Requirements for Recycled Water Use

Treatment Level	User Categories
Disinfected tertiary treatment	Food crops where recycled water comes into direct contact with edible portions; parks and playgrounds; school yards; and unrestricted access golf courses
Disinfected secondary treatment with coliform not exceeding a most probable number of 23 per 100 milliliters	Restricted access golf courses; pasture for animals producing milk for human consumption; and nonedible vegetation where access is controlled
Undisinfected secondary treatment	Orchards or vineyards where the recycled water does not come into contact with edible portion; and fodder or pasture for animals not producing milk for human consumption

Title 22 also sets forth requirements for separation between areas irrigated with reclaimed water and domestic groundwater wells, with separation distances as follows:

- 50 feet for disinfected tertiary treated water (unless several additional criteria are met),
- 100 feet for disinfected secondary water, and
- 150 feet for undisinfected secondary water.

4.1.2.8 RWQCB Policy on Use of Wastewater to Create, Restore, or Enhance Wetlands

In the north bay, the RWQCB prohibits discharges of municipal wastewater effluent discharges that exceed the applicable water quality standards if the quantity of receiving water does not provide an initial dilution capacity for the effluent of at least 10:1. Resolution 94-086 established objectives and guidance for an exception to this shallow-water-discharge restriction that allows effluent discharges in such situations if the effluent is used to create, restore, and/or enhance wetlands. The policy requires that the wetland restoration project must provide a net environmental benefit and the beneficial uses that are established in the wetland must be fully protected. A management plan must be prepared that describes project objectives, design and engineering considerations, operations and maintenance procedures, and monitoring programs.

4.1.3 Regional Setting

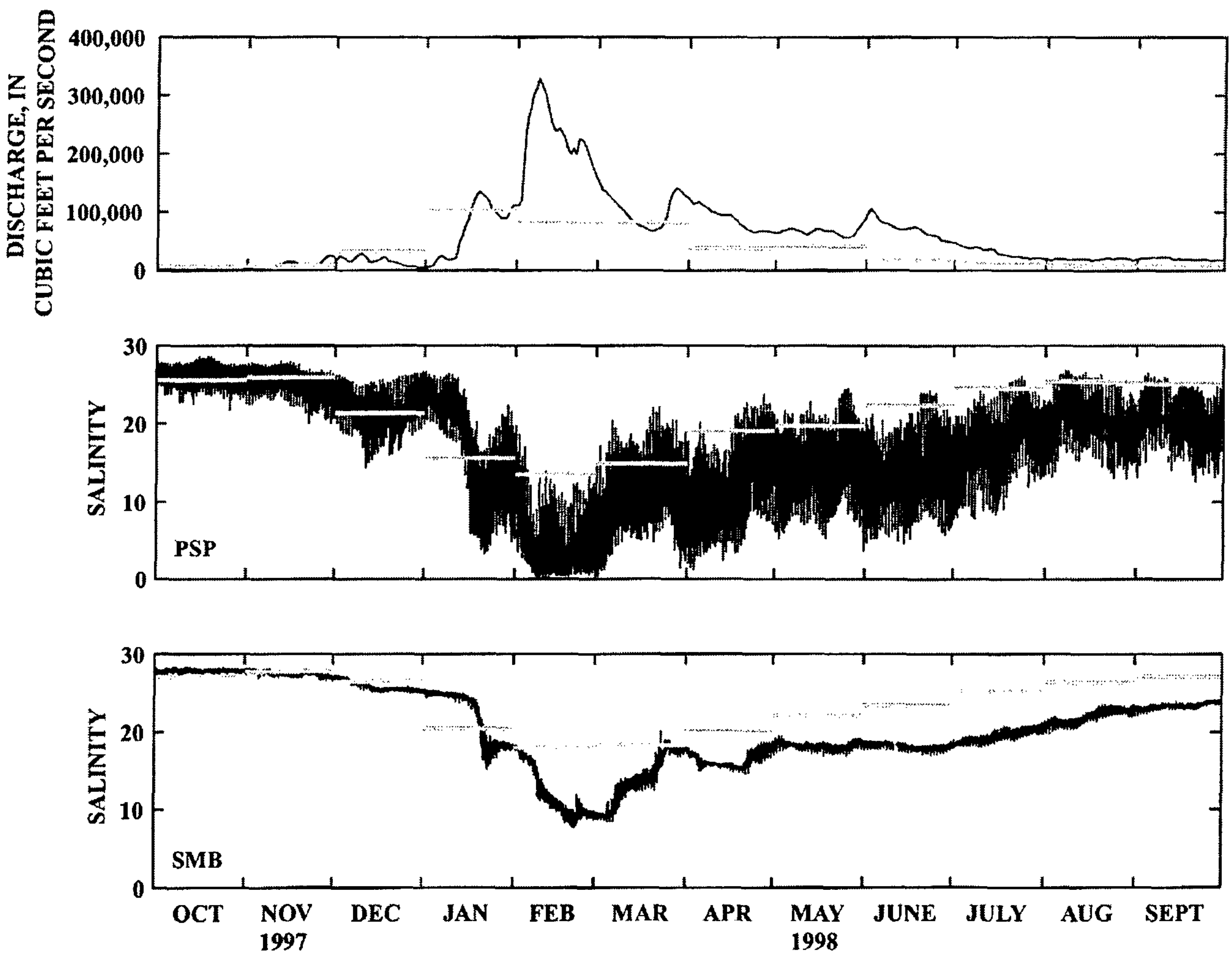
The hydrologic processes and fate and transport factors for chemical constituents in San Francisco Bay, its tributary rivers, and adjacent estuaries are complex and result in dynamic water quality conditions. Water quality in the Bay-Delta

estuary is largely a function of the mixing of ocean water and freshwater inflows from precipitation, the Delta, and other tributary streams. The physical mixing of sediment, nutrients, and salts combine with natural processes of light and heat input and associated primary and secondary production in higher trophic levels in the aquatic ecosystem of the bay. These ecosystem functions have secondary effects on dissolved oxygen, pH, and organic matter production and decay. In addition, the discharge of anthropogenic sources of conventional inorganic contaminants and trace metal and synthetic organic compounds also play a major role in the quality of bay water and sediments. Examples include municipal and industrial wastewater treatment discharges and urban stormwater runoff.

4.1.3.1 Salinity

Salinity in the Bay-Delta estuary reflects a balance between the saline marine influence, freshwater dilution, and the effects of evaporation. Undiluted seawater has an average salinity of about 35 ppt and distilled fresh water is defined as having 0 ppt salinity. Estuarine or brackish water represents salinity that lies between pure freshwater and pure saltwater conditions. Saltwater is considerably more dense than fresh water; therefore, fresh water will float on top of saline water. The density difference between saline and fresh water conditions also influences physical mixing between water layers of varying density. In general, salinity is lower in the northern portion of San Francisco Bay and higher in the southern portion, because San Pablo Bay receives substantially greater freshwater influx from the Delta. Freshwater inflow from the Delta also contributes to a much greater seasonal variation in salinity conditions in the north bay than in the south bay. The salinity in the sloughs of San Pablo Bay varies seasonally. During periods of high flow (particularly the winter rainy season), increased freshwater influx via San Pablo Bay's creeks decreases the salinity in the sloughs. Slough salinities increase during the summer low-flow period when freshwater influx is reduced.

The USGS and San Francisco Estuary Institute Regional Monitoring Program (RMP) conduct extensive water quality monitoring activities in San Francisco Bay and its freshwater tributaries (San Francisco Estuary Institute 1999, 2000a). The USGS operates a continuous salinity meter at Point San Pablo and has operated several continuous TSS recorders (e.g., Benicia Bridge, Carquinez Bridge, Point San Pablo) in recent years. Figure 4-1 shows a time series of continuous salinity measurements collected at Point San Pablo and the San Mateo Bridge during the 1998 water year in relation to Delta outflow (U.S. Geological Survey 2000c). (Note that this figure shows data from an extremely wet year that is not at all typical.) Analyses indicate that salinity in San Pablo Bay varies over a wide range during the year from nearly fresh water to nearly pure sea water. Salinity also exhibits a distinct variation that correlates with the spring-neap tidal cycle with spring tides having greater energy to force seawater further into the estuary. The spring-neap tidal cycle is generally more pronounced in the north bay.



Source: U.S. Geological Survey 2000.

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Figure 4-1
Time Series of Delta Outflow and Salinity at Point San Pablo and San Mateo Bridge – Water Year 1998

4.1.3.2 Suspended Sediment

Like salinity, suspended sediment concentration is controlled by a balance of factors. Key influences on suspended sediment are loading from inland streams, tidal influences on dilution and mass loading of biotic suspended matter (algae, zooplankton), and resuspension of previously deposited sediments within the bay. Resuspension of sediments within the bay is a function of tidal currents, wind strength and direction (i.e., the strength of wind-driven wave currents), and freshwater inputs. Freshwater influx shows a strong seasonal variation, with a peak during the winter (November–April) rainy season; land-derived sediment loading shows a corresponding peak in the winter. Tidal currents vary on a semimonthly basis from neap tides to spring tides, with the greatest sediment mobility at spring tides.

In general, TSS concentrations are highest in the San Pablo Bay region and at the southern end of San Francisco Bay. TSS concentrations are typically lower in central San Francisco Bay. USGS data show average concentrations of ~80–150 milligrams per liter (mg/l) in San Pablo Bay (Northwest Hydraulic Consultants 2001). High TSS levels in San Pablo Bay are generally associated with sediment input associated with Delta inflows.

Figure 4-2 shows continuous TSS concentration monitoring data at Point San Pablo for the 1998 water year that indicates seasonal conditions are influenced by a combination of Delta inflow and tidal action in San Francisco Bay (U.S. Geological Survey 2001). Figures 4-3 and 4-4 show seasonal variation of TSS data for the 1999 water year at Point San Pablo and within the Mare Island Strait for both mid-depth and near-bottom locations in the water column (U.S. Geological Survey 2001). These plots reflect the wide range of TSS concentrations that can be present as influenced by Delta outflow discharge patterns and tidal action. Measured TSS concentrations range from relatively low values of less than 50 mg/l TSS to very turbid conditions exceeding 1,000 mg/l TSS. Seasonal RMP grab samples also indicate that TSS concentrations are generally elevated in the Napa and Petaluma Rivers compared to San Pablo Bay (San Francisco Estuary Institute 2000a). However, the total sediment transport from the upper watersheds is minimal compared to the quantities of sediment derived from Delta outflow and wind- and wave-driven resuspension of bay sediments. In addition, Warner (2000) identified a complex tidally and salinity driven mechanism that acts to increase TSS transport into Mare Island Strait and the lower Napa River from the Carquinez Strait. Essentially, the earlier timing of flood tides with high TSS levels into Mare Island Strait compared to the Carquinez Strait provides high TSS conditions, and the convergence with lower salinity Napa River outflow creates a standing wave that allows elevated deposition rates. An average suspended sediment concentration of 125 mg/l was assumed to be characteristic of the project area (PWA 2002c), and was used to estimate the rate of habitat development in Pond 3 (closest to Mare Island Strait). A more conservative suspended sediment concentration of 75 mg/l was used to estimate the rate of habitat development in Ponds 4 and 5. This lower suspended sediment concentration accounts for the effect of Pond 3 sediment demand and the greater distance to Mare Island Strait.

4.1.3.3 Priority Trace Metal and Organic Compounds in Water and Sediment

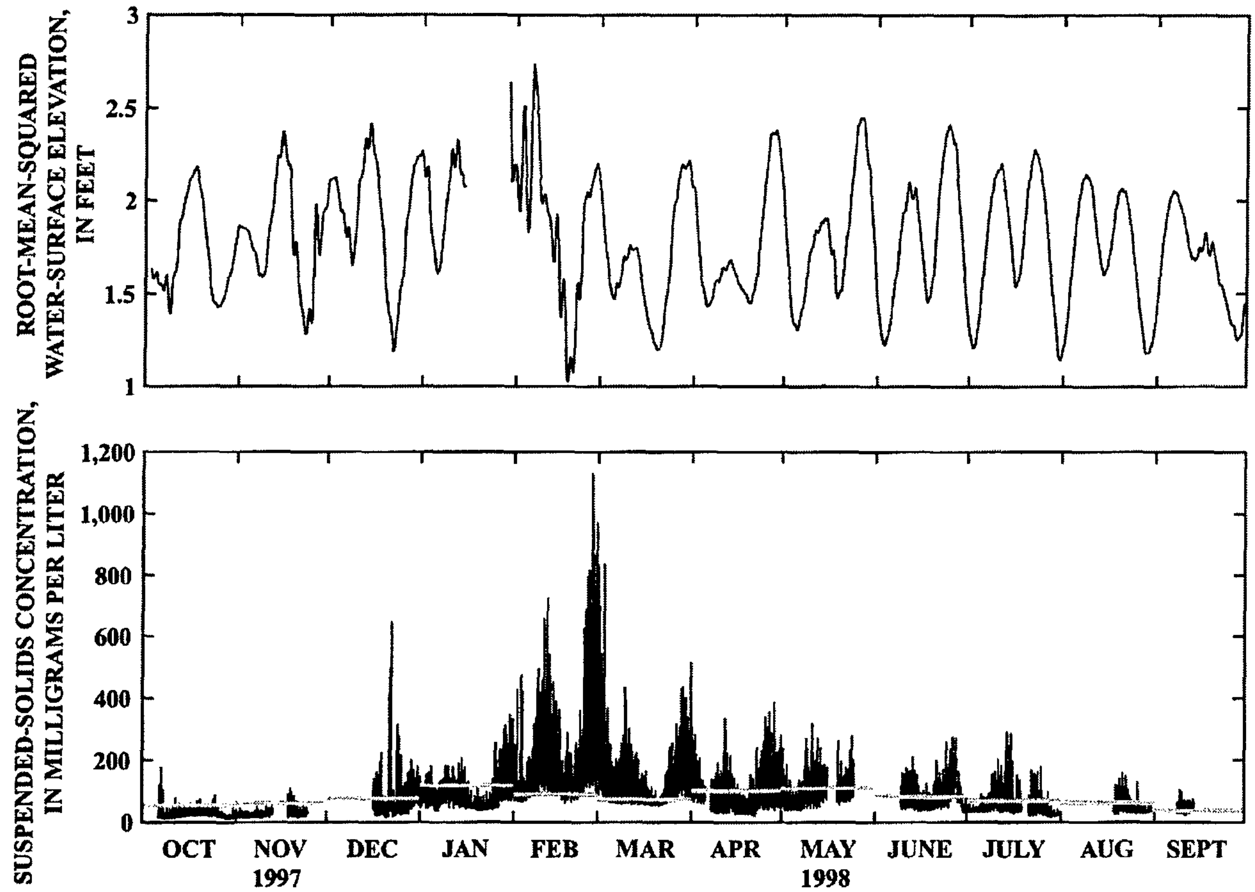
Water

Water and sediment contamination from priority trace metal and synthetic organic compounds in the San Francisco Bay area largely reflects the influence of past and present agricultural and mining activities, industrial uses, and urban development (San Francisco Estuary Institute 1999). Contaminants known to be present in waters and sediments of the Bay-Delta estuary include heavy metals (lead, copper, aluminum, mercury, nickel, vanadium, chromium, silver, zinc), polycyclic aromatic hydrocarbons (PAHs), PCBs, chlorinated hydrocarbon pesticides, and tributyltin (San Francisco Estuary Institute 1999, 2000a, San Francisco Bay RWQCB 1998).

Within the north bay region, constituents of concern that routinely exceed numeric guidance levels, human health guidelines, and/or regulatory concentration criteria in water samples collected for the RMP monitoring program include copper, mercury, and PCBs (San Francisco Estuary Institute 2000a). Table 4-5 shows RMP average concentration values for selected constituents measured during the 1993–1999 period in the Napa River and San Pablo Bay. For the Napa River and San Pablo Bay samples, only copper exceeded applicable criteria on an average basis; however, individual measurements of mercury, copper, nickel, chromium, lead, and zinc exceeded criteria on one or more occasions (San Francisco Estuary Institute 1999). Organic compound concentrations of PCBs and dichlorodiphenyldichloroethelene (DDE) were also measured above water quality guidelines at least once in the Napa River and San Pablo Bay. The sum of 40 PCB congeners was well above the congener-based total-PCB criterion of 170 picograms per liter (pg/l) in all but eight of the RMP sampling locations. While the concentrations of PCBs have dropped since the 1970s, the RMP monitoring data have shown no clear trends in recent years. Measured exceedances of metals and organic compounds occurred less frequently in other north bay sampling locations (i.e., Davis Point, Pinole Point).

The sources and magnitude of contaminant loading to San Francisco Bay have been recently characterized as consisting primarily of the following categories: Central Valley via Delta inflows, local runoff of rivers and stormwater runoff, point-source discharges to the bay from municipal and industrial facilities, atmospheric deposition, and dredged material disposal (San Francisco Estuary Institute 2000b). Overall, the report indicated that TSS and contaminant influxes from the Delta comprise a large majority of the total loading in San Francisco Bay. Atmospheric deposition and dredged material disposal represent relatively small contributions.

The relative magnitude of contaminant loading from local watershed sources and point-source discharges depends on the particular chemical constituent in question. For example, point-source discharges comprise the majority of inorganic nutrient (nitrogen [N] and phosphorus [P]) loading to San Francisco



Source: U.S. Geological Survey 2000.

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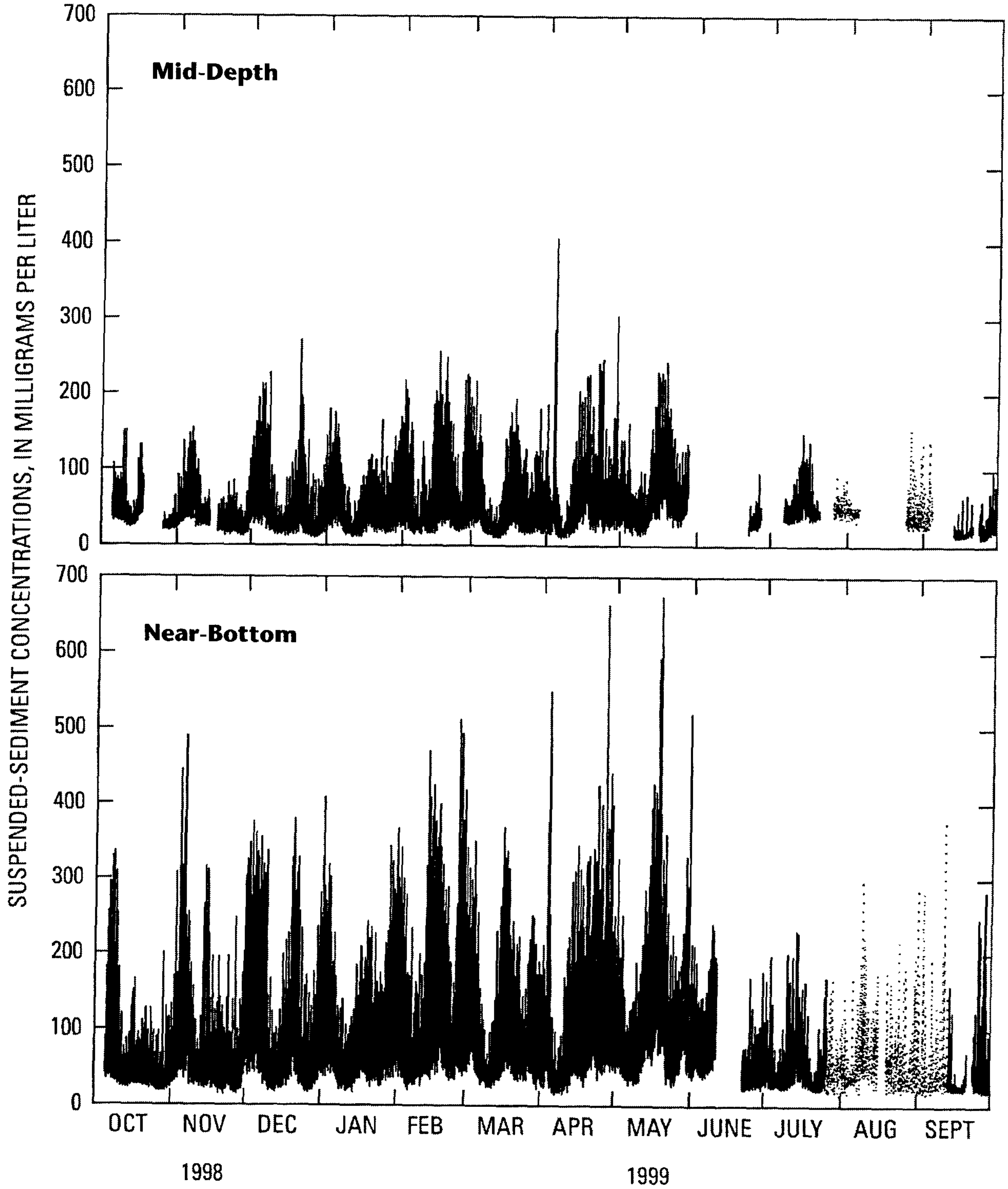
Figure 4-2
Time Series of Total Suspended Solids and Tidal Elevation at Point San Pablo – Water Year 1998



Source: U.S. Geological Survey 2001.

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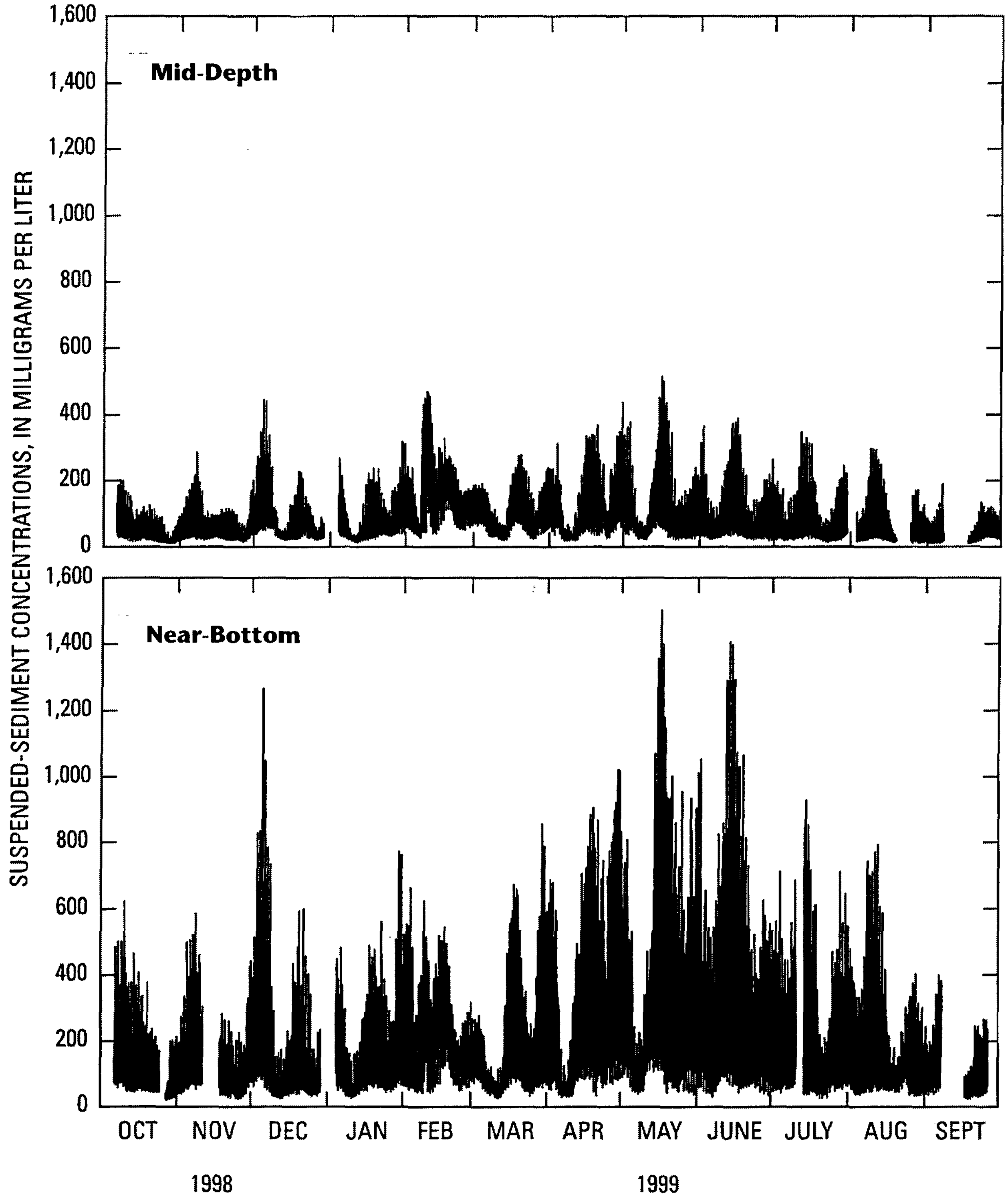
Figure 4-3
Time Series of Mid-Depth and Near-Bottom Total Suspended Solids at Point San Pablo – Water Year 1999



Source: U.S. Geological Survey 2001.

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Figure 4-4
Time Series of Mid-Depth and Near-Bottom Total Suspended Solids at Mare Island Causeway – Water Year 1999

Bay, whereas trace metals inputs are primarily associated with local watershed sources. Relative source contributions of organic compounds have not been determined. Within the category of local watershed runoff, the Napa River, Petaluma River, and Sonoma Creek watersheds were found to contribute a relatively high percentage of the total San Francisco Bay area load of selected trace metals (cadmium, chromium, copper, lead, nickel, and zinc) compared to other watersheds.

Table 4-5. Water Contaminant Levels of the Napa River, San Pablo Bay and the Salt Ponds Project Area[1]

Location[2]	Salinity (tds)	As (μg/l)	Cr (μg/l)	Cu (μg/l)	Pb (μg/l)	Hg (μg/l)	Ni (μg/l)	Zn (μg/l)	Total PCBs (μg/l)[3]
Napa River	—	2.8	12.0	5.9	2.0	0.021	10.2	13.0	0.000558
San Pablo Bay	—	2.6	11.5	5.5	2.0	0.024	9.3	8.6	0.000758
Pond 1	40,050	19.5	<10	31	10	<0.1	<10	13	<MRL
Pond 1A	163,950	12.0	<10	53	<2	<0.1	<10	47	<MRL
Pond 2	38,425	10.5	<10	34	<2	<0.1	11	26	<MRL
Pond 2A	21,850	<6	<10	20	<2	<0.1	<10	<20	<MRL
Pond 3	66,475	ND	ND	53	ND	ND	ND	59	<MRL
Pond 4	37,500~~323,000~~	~~≤30~~2.53	~~≤500~~0.65	~~287~~1.51	~~≤100~~1.05	~~≤0.5~~0.00626	~~≤500~~8.7	~~725~~2.82	<MRL
Pond 5	~~323,667~~	~~87.0~~	~~<100~~	~~253~~	~~<20~~	~~<0.1~~	~~<100~~	~~1027~~	<MRL
Pond 6	92,100	<24	28.7	<40	<8	<0.1	<40	75	<MRL
Pond 6A	57,533	<24	<40	<40	<8	<0.1	<40	<80	<MRL
Pond 7	396,000~~353,500~~	~~125~~9.2	~~≤100~~50.3	~~1519~~4.34	~~≤20~~2.81	~~≤1.0~~0.02	90	~~3380~~560	<MRL
Pond 7A	47,800~~96,400~~	~~≤60~~3.75	~~≤100~~48.4	~~65~~0.79	~~≤20~~0.20	≤0.~~5~~01	~~≤100~~7.80	~~≤200~~3.51	<MRL
Pond 8	21,400~~293,667~~	~~≤300~~0.81	~~≤500~~23.9	~~373~~1.34	~~≤100~~0.31	≤0.~~5~~01	~~≤500~~4.40	~~1840~~2.31	<MRL
WQC		36	209	3.2	20.4	0.029	7.2	61.3	

- No Data

1 Average of measurements at each salt pond in total dissolved solids (tds); measurements can vary substantially during the year depending on the pond depth and amount of rainwater present in a pond.

2 Sources: Napa River and San Pablo Bay values calculated from San Francisco Estuary Institute data (URL:/ www.sfei.org/rmp/data.htm); salt pond data from Hydroscience 2002, updated based on October 1, 2003, sampling and precipitation-based sample evaluation method. Pond 5 is assumed to be the same as Pond 4 because of the connectivity of the pond waters.

3 Total PCBs concentration data from salt ponds were all below method reporting limit (MRL), which varied from 0.5 to 2.5 μg/l.

Sediment

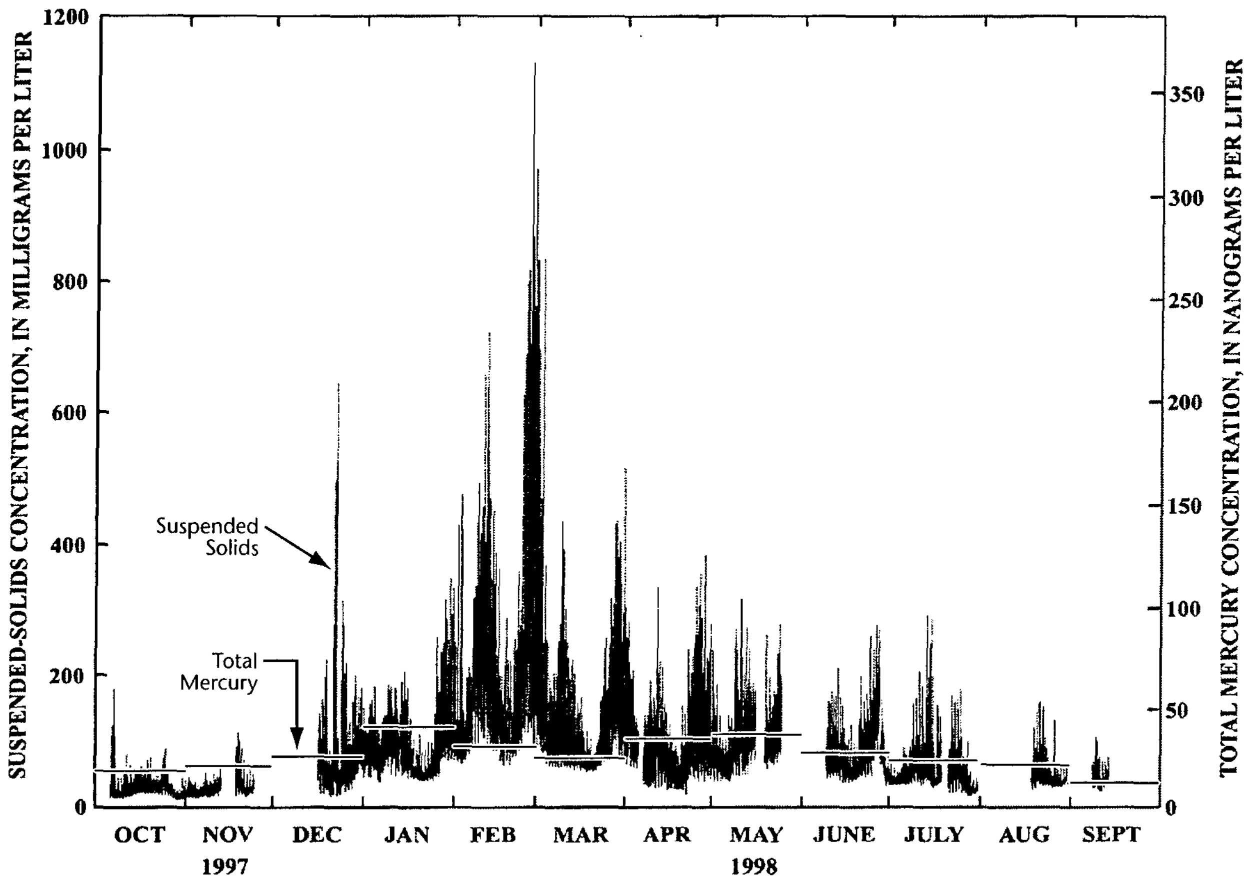
RMP monitoring data for 1993–1999 average sediment constituent concentrations in the Napa River and San Pablo Bay are shown in Table 4-6. The data indicate that both water bodies exceed one or more guidance criteria (refer to table 4-3) for arsenic, chromium, copper, mercury, nickel, and total dichlorodiphenyltrichloroethane isomers (DDTs) (San Francisco Estuary Institute 1999, 2000a). RMP data for the Napa River indicate that mercury, PCBs, total DDTs, arsenic, copper, and chromium exceeded sediment guidelines in more than 90% of the samples collected from 1993 to 1999 (San Francisco Estuary Institute 2000a). San Pablo Bay sediment also exceeds criteria for total PAHs. The former Mare Island Naval Shipyard is also a potential point source of TBT, a highly toxic endocrine-disrupting chemical used as an antifoulant in ship paints. Sediment toxicity tests have also frequently been positive for Napa River samples; Davis Point samples have tested positive for sediment toxicity much less frequently.

Mercury Dynamics in an Estuary

Mercury contamination is widespread in sediments and waters of the San Francisco Bay area (San Francisco Estuary Institute 2000a, San Francisco Bay RWQCB 2000). Mercury is a constituent of particular concern to wetland restoration projects because of its ability to convert to the methylated form of the metal, which is relatively more mobile in the aquatic environment than other forms. Long-term RMP monitoring data for total mercury in water and sediment has consistently shown elevated concentrations, primarily in the north and south bay areas and river tributaries. There is also a strong correlation between total mercury and suspended sediment transport in the water (U.S. Geological Survey 2000c). Figure 4-5 shows the continuous TSS data and calculated mercury concentrations that would be expected at Point San Pablo, based on their known correlation relationship.

Elevated mercury levels are in large part a legacy of the California gold mining era, when mercury was used in the gold refining process. Mines such as south San Francisco Bay's New Almaden Mine, which operated for many years in the upper Guadalupe River watershed extracting the mercury ore cinnabar, are known to be a source of mercury in the bay system. Over time, leaching of mine tailings and overland transport of mercury-bearing sediments have resulted in the downstream accumulation of mercury in the watershed. Mercury is also delivered to the San Pablo Bay system via the Delta.

In aquatic environments, most mercury is chemically bound to suspended particles of soil or sediment; a smaller fraction is bound to dissolved organic carbon. Sediment-bound mercury may be available to aquatic organisms and is thus a pollutant of concern; the potential for adverse environmental effects from sediment-bound mercury depends primarily on transport and depositional characteristics (e.g., particle size) and on the physical and chemical properties of the sediment.



Source: U.S. Geological Survey 2000.

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Jones & Stokes

Figure 4-5
Time Series of Mid-Depth Total Suspended Solids and Calculated Total Mercury Concentration at Point San Pablo – Water Year 1998

Table 4-6. Sediment Contaminant Levels of the Napa River, San Pablo Bay, and the Salt Ponds Project Area[1]

Location[2]	As (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Ni (mg/kg)	Se (mg/kg)	Zn (mg/kg)	Total PCBs (µg/kg)[3]	Total PAHs (µg/kg)[4]	Total DDTs (µg/kg)[5]
Napa River	12.9	109	61.3	25.9	0.330	104	0.55	144	5.92	1279	5.46
San Pablo Bay	14.1	92.4	49.3	21.3	0.330	84.6	0.43	118	4.02	4274	4.07
Pond 1	12.6	109	60.2	31.7	0.335	107	1.4	126	<MRL	- -	1.88
Pond 1A	14.0	87	45.0	29.6	0.180	77.6	1.4	82	<MRL	<MRL	<MRL
Pond 2	15.3	95	37.7	19.8	0.115	84.6	0.98	84	<MRL	<MRL	<MRL
Pond 2A	24.8	98	74.8	35.7	0.290	116	3.4	142	<MRL	<MRL	4.28
Pond 3	18.1	74	40.8	25.2	0.258	65.1	3.2	79	<MRL	<MRL	1.30
Pond 4	5.78	22	10.1	10.4	0.048	28.8	0.98	25	<MRL	<MRL	2.45
Pond 5	18.7	63	39.2	28.6	0.110	64.4	2.1	71	<MRL	<MRL	7.04
Pond 6	9.85	46	18.2	15.8	0.062	51.4	1.1	49	<MRL	<MRL	2.09
Pond 6A	11.5	58	29.0	21.7	0.170	67.0	1.5	61	<MRL	<MRL	<MRL
Pond 7	10.4	38	12.9	8.50	0.027	29.6	1.2	343	<MRL	- -	<MRL
Pond 7A	15.2	59	27.0	15.6	0.069	90.0	1.1	66	<MRL	<MRL	6.22
Pond 8	8.3	45	18.3	6.30	0.067	30.9	1.3	32	<MRL	<MRL	<MRL

1 Average of measurements at each salt pond.

2 Sources: Napa River and San Pablo Bay values calculated from San Francisco Estuary Institute data (URL:/ www.sfei.org/rmp/data.htm), salt pond data from Hydroscience 2002.

3 Total PCBs concentration data from salt ponds were all below the method reporting limit (MRL), which varied from 3.9 to 56 µg/kg.

4 Total PAHs data from majority of salt ponds were below the MRL, which varied considerably. The symbol (--) indicates individual PAH isomers (fluoranthene and/or pyrene) were detected in single samples from ponds 1 and 7; however, a total PAHs value is not available.

5 Total DDTs data from salt ponds were below the MRL, which varied from 1.68 to 24.5 µg/kg.

Additionally, sediment-bound mercury may be converted through both biotic and abiotic processes to its more bioavailable methylated form. Factors conducive to methylation of mercury include low-flow or stagnant waters, hypoxic or anoxic conditions in the water or sediment column, low pH (pH<6), and high concentrations of dissolved carbon. Most of these factors are in turn affected by biological processes such as metabolism, growth, and decay; for example, mercury methylation has been linked to the activity of sulfate-reducing bacteria in the shallow anoxic sediment column.

Aquatic plants, fish, and wildlife readily adsorb methyl mercury. It can then accumulate in their tissues, creating contaminated food sources (plant or animal tissues) that transfer through the food web (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). It is a mutagen, teratogen, and carcinogen, and has embryotoxicological, cytochemical, and histopathological effects. In aquatic organisms, concentrations of 0.1–200 μg/l have been shown to produce adverse effects; toxicity increases with age of the organism, exposure time, temperature, lowered salinities, and the presence of other metals.

4.1.3.4 Treatment Plant Discharge

WWTPs are monitored as point sources of pollution, and most plants in the north bay region are converting to tertiary treatment to meet increasingly stringent discharge permit requirements. The WWTPs in the north bay region discharge recycled water to area waterways only during the wet season. The SVCSD WWTP discharges to Schell Slough, the NSD WWTP discharges to the Napa River 14 miles upstream from the confluence with San Pablo Bay (downstream of Carquinez Strait), and the CAC WWTP discharges into ~~the~~ North Slough and adjacent constructed wetlands.

Table 4-7 shows effluent data from selected north bay WWTPs that may consider participating in the restoration of the Napa River Unit. In general, the WWTPs produce effluent that has moderate inorganic mineral content with low suspended solids and turbidity relative to the natural background conditions in the Napa River and San Pablo Bay. The pH values are neutral, and along with ammonia and whole effluent toxicity test data, the effluent usually is in compliance with regulatory permit limits.

High analytical detection limits used for some of the trace metals preclude comparisons with applicable Basin Plan water quality objectives (refer to Table 4-2). However, NSD and City of Petaluma effluent discharges generally contain low levels of copper and mercury, which are listed on the 303(d) list as substances responsible for the impairment of San Pablo Bay. Novato SD and LGVSD discharges have elevated copper and mercury concentrations. These substances are considered in the NPDES permits issued by the San Francisco Bay RWQCB, although the allowable discharge levels could change when the TMDL process is complete. The City of Petaluma and LGVSD WWTP data also indicate that zinc concentrations are periodically elevated relative to Basin Plan water quality objectives.

4.1.4 Project Setting

The project area of interest with regard to water quality issues is primarily defined as the salt ponds, adjacent sloughs, immediately adjacent Napa River area, and northern San Pablo Bay. Salinities of water in the salt ponds undergoing evaporative concentration are significantly higher than those in nearby San Francisco Bay waters. The processes that affect the transport of sediment, salts, and other water quality constituents in adjacent waterways are complex and driven by asymmetric tidal systems to the east and west of the pond system producing a barotropic convergence zone within the slough system. In addition, the transport process is strongly affected by the baroclinic convergence zone created by the phase difference between the two deep tidal channels, Mare Island and the Carquinez Strait. This complex process is a function of density differences between waters of variable salinity and tidal action and is related to the timing of salinity pulses in the Napa River, San Pablo Bay, and Mare Island Strait/Carquinez Strait junction.

The amount of data regarding chemical constituents in the nearby receiving waters, pond waters, and pond sediments is limited. Two baseline studies of inorganic constituents and the variation that occurs in the ponds have been conducted in recent years (Takekawa et al. 2000, Warner et al. 1999). The Coastal Conservancy contracted with Hydroscience Engineers (2002) and PWA to collect water and sediment grab samples in September 2001 in all of the ponds and in the high salinity ponds in October 2003 (Frontier Geoscience 2003); the data are described below and are shown in Tables 4-5, 4-6, and 4-8.

4.1.4.1 Salinity in Pond Water

The salinity patterns in the salt ponds have been extensively described in Chapter 2, "Site Description and Options." Table 4-8 also shows the average total dissolved solids (TDS) and chloride concentrations in pond water based on grab samples (Hydroscience Engineers 2002). Salinity levels in the salt ponds depend on inflows to the ponds and water management procedures implemented currently by DFG, baroclinic influences, evaporation, precipitation, and runoff.

Salinity records indicate a general trend of increasing salinity in the sloughs toward the southwest of the project area as the influence of the Napa River declines and the influence of San Pablo Bay increases. This trend is reinforced seasonally as Napa River flows decline in summer. Another general trend may be caused by the influence of waters discharging from the Delta through the Carquinez Strait, which produces an increasing salinity gradient toward the west of the project area as the fresh water moves into San Pablo Bay.

Salinity in the Napa River varies daily because of diurnal tidal influence from San Pablo Bay and seasonally as a result of changes in freshwater runoff. Daily fluctuations are on the order of 5 ppt; seasonal variations are on the order of 20 ppt (from completely fresh water during high spring runoff to heavy seawater

Table 4-7. Summary of Representative Effluent Constituent Concentrations in Wastewater Treatment Plants

Constituent	Napa (year 2000)			Petaluma (year 2000)			Novato (year 1999)			Las Gallinas (year 2000)			Sonoma (year 2001)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min.	Max.	Avg.
Temperature (C)	12.4	22.3	17.0	ND	ND	ND	14	26	20	16	19	17	18.5	22.7	20.9
BOD (mg/l)	8	22	14.6	14.3	25	18.4	3	41	8	5.5	11.3	8.3	<5	9.5	5.5
TSS (mg/l)	10	22	16	2.4	64.6	44.5	2	19	6	8.6	32	14.4	2.1	6.4	3.7
pH	6.9	7.9	7.6	7.31	7.62	7.46	7.0	8.3	7.6	6.9	7.5	7.2	6.5	6.9	6.6
Ammonia (mg/l)	ND	ND	ND	1.6	15	9.1	0.9	6.6	2.9	0.1	2.8	1.2	0.25	0.47	0.33
Turbidity (NTU)	0.9	11.1	4.9	12.7	43.7	26.9	2	24	10	ND	ND	ND	1.3	3.0	2.2
Toxicity, % survival	25	100	88	95	100	99	ND	ND	ND	97	100	ND	84	100	96
Chlorophyll (µg/l)	ND	ND	ND	143	300	221	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (µg/l)	<2	<2667	<270	<2	3	2.08	<2	3	ND	<2	<2	<2	<2	<2	<2
Cadmium (µg/l)	<0.2	<0.2	<0.2	<2	<2	<2	<0.2	<0.2	ND	<1	<2	<2	<1	<1	<1
Chromium, total (µg/l)	<1	<2	<1	<1	4	1.5	<2	12.8	ND	<1	1.5	<1.2	<2	<2	<2
Copper (µg/l)	0	<15	<4	<2	3.5	2.38	7	15	ND	7	13	9.7	7.1	10.8	8.9
Cyanide	<3	<3	<3	<3	6	4.3	<3	<3	ND	<3	7	<4	<6	<6	<6
Lead (µg/l)	<2	<2	<2	<2	<2	<2	<2	3	ND	<2	<2	<2	<2	<2	<2
Mercury (µg/l)	<0.00005	<.007	<.00173	0.00421	0.0103	0.0063	0.02	0.10	ND	0.024	0.050	0.034	0.0034	0.0076	0.0053
Nickel (µg/l)	<2.2	<3	<3	<3	27	6.69	<5	17	ND	<3	5	3.9	3	3	3
Selenium (µg/l)	<1	<20	<2	<1	<1	<1	<1	<1	ND	<1	1	<1	<5	<5	<5
Silver (µg/l)	<0	<0	<0	<0.5	<0.5	<0.5	0.8	1.6	ND	<0.5	1.1	0.9	<2	<2	<2
Zinc (µg/l)	<4	<34	<20	<20	40	23.1	23	38	ND	60	110	85	49.75	68.83	58.83
Phenols (µg/l)	<5	<20	<8	ND	ND	ND	<5	5	ND	<5	10	7	ND	ND	ND
PAHs	<5	<20	<8	<0.3	<0.3	<0.3	<MRL	<MRL	ND	<MRL	<MRL	<MRL	ND	ND	ND

Notes:

BOD = biological oxygen demand
TSS = total suspended solids
µg/l = micrograms per liter
mg/l = milligrams per liter
MRL = method reporting limit
ND = no data available
NTU = *nephelometric turbidity units*
PAH = polycyclic aromatic hydrocarbon

No data available from CAC WWTP at this time.

Table 4-8. Average Concentrations of Conventional and Trace Metal Constituents in the Salt Pond Water Samples

Parameter (units)	Pond 1	Pond 1A	Pond 2	Pond 2A	Pond 3	Pond 4	Pond 5	Pond 6	Pond 6A	Pond 7	Pond 7A	Pond 8
Ammonia (mg/l N)	0.25	0.32	0.25	0.40	0.23	3.38	3.63	0.32	0.24	39.5	0.34	128
Nitrate (mg/l N)	0.7	0.6	0.5	0.3	2.0	6.0	6.2	3.4	1.2	6.4	2.0	1.0
TKN (mg/l N)	2.8	4.2	4.4	1.3	12.4	55.2	59.9	7.0	5.4	111	12.2	130
pH	8.4	9.1	8.9	7.9	8.3	7.7	7.6	8.4	8.8	5.0	8.6	3.3
BOD (mg/l)	4.9	26.7	11.5	1.5	28.7	15.9	4.1	8.7	8.8	44.6	48.4	29.3
Turbidity (NTU)	9.5	23.6	29.2	7.2	59.4	92.0	83.2	12.2	19.6	145	46.5	36.3
TSS (mg/l)	62	47	ND	ND	168	444	533	31	53	354	84	102
TDS (mg/l)	40,050	164,000	38,430	21,850	66,480	323,000	323,700	92,100	57,530	353,500	96,400	293,700
Chloride (mg/l)	22,900	33,600	22,250	12,000	38,900	174,500	173,700	54,200	32,200	226,000	53,300	150,700

Notes:

N = Nitrogen
TKN = total Kjeldahl nitrogen
BOD = biochemical oxygen demand
NTU = nephelometric turbidity units
TSS = total suspended solids
TDS = total dissolved solids
ND = none detected

Source: Hydroscience 2002

influences during the dry season). Salinity in San Pablo Bay in the vicinity of the salt ponds may vary by as much as 10 ppt seasonally, with the salinity level in a small near-shore area having the potential to become freshwater (0 ppt) during heavy rainfall periods.

4.1.4.2 Temperature, Dissolved Oxygen, and pH

Water temperature is an important physical parameter that affects the metabolic rate of aquatic organisms, tolerance of aquatic organisms to other environmental stressors, and other physical and chemical water quality processes. The solubility of dissolved oxygen (DO) in water is a direct function of water temperature, with maximum possible DO values being lower at higher water temperatures. The most extensive information for conventional constituents of concern in the salt ponds comes from recent data collected with continuous monitoring equipment for temperature, DO, pH, and turbidity (Takekawa et al. 2000). The maximum recorded temperature in the salt ponds was 30°C in August and the minimum was 7°C in February. DO concentrations were generally lowest in Ponds 4 and 7; however, DO in these ponds ranged from a relatively low value of 0.6 mg/l to as much as 7.0 mg/l, which can still sustain aquatic life. Average DO concentrations were slightly higher in Ponds 2, 2A, and 3. The highest overall DO concentration conditions were recorded in Pond 1 and ranged from 7 to 12 mg/l. Seasonal patterns in the DO concentrations were evident with generally lower values in the summer and higher values in the winter.

The pH values (a measure of acidity) generally vary considerably among the ponds and are generally within the Basin Plan objectives of 6.5 to 8.5 (refer to Table 4-8). Extremely low pH values were previously measured in Pond 8 (2.9–3.2), indicating strongly acidic conditions. However, conditions in Pond 8 typically exhibited a seasonal pattern with higher levels of approximately pH 5 when more water was~~is~~ present and have returned to normal following the operation of the two new water intakes. Low pH values also occurred in Pond 7 (4.4–5.1). Seasonally, pH values were generally lower from September through November and higher in the early spring, when more water is present.

4.1.4.3 Nutrients, Suspended Sediment, and Turbidity in Pond Water

Ammonia, nitrate, and total Kjeldahl nitrogen values measured in 2001 (Table 4-8) indicate that Ponds 4, 5, 7, and 8 have the highest concentrations of these plant nutrients. Nitrogen and phosphorus are primary nutrients necessary for growth of algae and aquatic vascular plants. However, there are no monitoring data for the existing rates of algae or plant growth in the ponds.

Takekawa et al. (2000) found turbidity to be highest in Pond 1, ranging from 200 to 800 NTU. Turbidity is known to be associated with wind and wave agitation that results in the resuspension of precipitated salts from the sediment surface. Turbidity varied widely in Ponds 2, 2A, 3, 4, and 7 from 20 to 250 NTU.

Turbidity was relatively constant in Pond 2A, from 50 to 110 NTU. The 2001 data shown in Table 4-5 indicate that Ponds 4, 5, and 7 had the highest turbidity and TSS values due to low water levels and high salinity at the time of sampling. TSS concentrations in the typical tributary sloughs to San Pablo Bay and the Napa River generally decrease with increasing distance from San Pablo Bay, ranging from 41 mg/l to 386 mg/l (Warner et al. 1999).

4.1.4.4 Trace Metals and Organic Compounds in Pond Water

The 2001 and 2003 sample results shown in Table 4-5 represent the most complete characterization of trace metal and organic compound concentrations in the ponds. In the Coastal Conservancy's and DFG's restoration efforts in the South San Francisco Bay, it became apparent that there were inaccuracies in the laboratory analysis of aqueous metals samples due to elevated levels of salinity. Therefore, a new sampling and metal evaluation procedure was proposed for Pond 4, 7, 7A, and 8 in the project area. Aqueous samples were collected on October 1, 2003 and transmitted under Chain-of-Custody to Frontier Geosciences where they underwent precipitation-based metals analysis. The new analysis indicated that metals in Pond 4, 7A, and 8 were measured to be below the applicable water quality control (WQC) limits except nickel in Pond 4 and 7A; nickel was detected at a level near the WQC (8.7 ug/L for Pond 4 and 7.8 for Pond 7A). The most stringent objective in the Basin Plan is 7.1 ug/L as total recoverable nickel. Pond 7 exceeded WQC limits for copper, nickel, and zinc. ~~It should be noted that single samples where detection did not occur (i.e., cadmium, lead, mercury, nickel, and silver) cannot be compared with Basin Plan and CTR water quality criteria because the laboratory detection limits were higher than the criteria. In addition, the effect of evaporative concentration on contaminant concentrations has not been evaluated. Evaporative concentration and associated lower volumes of water in the ponds during dry conditions may increase the concentrations of soluble constituents. When the ponds contain more water input from rainfall, the concentrations may be lower as a result of increased available dilution capacity. However, e~~Each pond had at least one calculated average concentration of arsenic, copper, lead, nickel, selenium, silver, or zinc that exceeded applicable criteria. ~~With the exception of Ponds 6 and 6A, copper concentrations exceeded criteria in all of the ponds. Zinc was also elevated in all ponds except 1/1A, 2/2A, 6A, and 7A. Overall, Pond 7 had exceedances of the criteria for the most constituents including copper, nickel, selenium, silver, and zinc.~~ All other ponds only exceeded criteria for one or two metals. In general, pond water concentrations of arsenic, copper, and zinc were substantially higher than comparable values in the Napa River or San Pablo Bay.

Evaporative concentration and associated lower volumes of water in the ponds during dry conditions may increase the concentrations of soluble constituents. When the ponds contain more water input from rainfall, the concentrations of soluble constituents may be lower as a result of increased available dilution capacity. For example, the water levels in the ponds were low on October 1, 2003, and the average depth of the water in Pond 4 on this date was 1.4 feet. The

samples collected in October 2003 are likely to contain higher concentrations of dissolved constituents than samples collected in late winter/early spring, when the breach discharge is proposed. The average depth at the time of the breach discharge is anticipated to be at or near the maximum depth the pond can accommodate, which is 4.5 feet. The source of the additional water expected in Pond 4 at the time of the breach discharge will be primarily rainfall, which is expected to contribute no additional nickel to the pond.

It is expected that the volume of water impounded in Pond 4 at the time of the breach discharge will be at least three times the volume of water present on October 1, 2003. Therefore, conservatively assuming that the volume of impounded water at the time of the breach is twice the volume impounded on October 1, 2003, the concentration of nickel in Pond 4 at the time of the proposed breach discharge would be expected to be approximately one half of 8.7 μg/L (or approximately 4.4 μg/L).

4.1.4.5 Toxicity of Pond 7 Bittern and Brine Mixtures

Chronic aquatic toxicity testes (7-day) were conducted in 2002 (Pacific EcoRisk 2002) using *Americamysis bahia* (mysid), which was the most sensitive species in previous testing on Pond 7 samples conducted in 199~~0~~3. The 2002 toxicity test results were summarized and compared to available literature information regarding potential toxicity mechanisms in highly saline brines (Gaia Consulting 2002). Pond 7 bittern and Pond 8 hypersaline brine samples were collected on May 14, 2002 for the study. Four mixtures with the following bittern and brine ratios were created: 100% bittern/0% brine, 70% bittern/30% brine, 40% bittern/60% brine, and 10% bittern/90% brine. Each of the four test mixtures were diluted to test concentrations of 0.25%, 0.5%, 1%, 2.5%, 5% and 10% with saline dilution water having 20 ppt salinity. Toxicity tests were evaluated for both survival and growth endpoints. The bittern used had a salinity of 310 ppt.

Results from the toxicity tests with the four different mixtures showed that mysid survival rates exceeded 80% for all four of the test mixtures up to and including the 5% dilution test; survival for all of these tests were not significantly less than the laboratory control. Survival was 0% at the 10% dilution in all four test mixtures except the 10% bittern/90% brine mixture which had significantly lower survival than the laboratory control. Mysid biomass was also not significantly less than the control for dilutions up to and including 5%, except for Mixture 1 which contained 100% Bittern. For Mixture 1, the biomass was significantly less than the control at the 5% dilution.

Gaia Consulting (2002) reached two primary conclusions regarding the test results: 1) diluting the bittern with hypersaline brine does not appear to significantly increase the rate at which bittern could be discharged, and 2) the apparent toxicity of bittern in this study is lower than that found in prior studies, suggesting that higher discharge rates may be acceptable. These results differ from the previous bittern testing performed for the Napa Ponds in 199~~0~~3 which showed that only dilutions of 1% to 1.5% bittern had a mean survival rate that was not significantly lower than the control treatment. During previous studies,

complete mortality was noted at a 5% bittern solution. The precise salinity of the bittern used in these previous studies is not known, however, it is likely that the concentration was considerably higher (between 390 and 450 g/kg) than the recent testing because the bittern samples were collected shortly after salt production ceased. Because a variety of organisms were previously tested in 199~~0~~3, and more tests were conducted, the prior testing effort still provides the baseline for bittern discharge criteria. Gaia Consulting concluded that additional testing is required to confirm the findings of the 199~~0~~3 investigation and determine whether increased discharge rates for the bittern are possible.

The estimated time for Pond 7 bittern removal has decreased substantially since the release of the Draft EIR/EIS. According to studies conducted prior to the Draft EIR/EIS and Draft Feasibility Report, bittern removal and salinity reduction would take approximately 30 years with recycled water, and approximately 50 years using exclusively Napa River and Napa Slough inputs ("neighboring waters"). The new analysis estimates that it would take approximately 8–10 years using neighboring waters, and a slightly shorter period of time using additional recycled water. The change in estimated time results from using a mass-based rather than a flow-based discharged restriction.

Based on toxicity studies, the regulatory agencies have indicated that bittern discharge from Pond 7 must be limited to 1% of the total flow from the Upper Ponds. While this restriction implies a certain mass removal (based on the Year 1 initial bittern concentration and flow), in earlier iterations of the Corps's Draft Feasibility Report, this flow-based discharge restriction was assumed to apply throughout the life of the project. This flow-based approach resulted in very long time periods before bittern would be reduced sufficiently to create habitat value in Pond 7. Bittern removal using a flow-based discharge restriction requires a long time because as the bittern concentration in the pond drops, less and less bittern is removed each year.

Assuming that a constant mass of bittern (under a mass-based discharge restriction) can be removed each year means that the allowable flow discharged from Pond 7 can increase as the concentration of bittern in the pond decreases, resulting in a shorter restoration period than previously expected.

4.1.4.6 Constituents in Pond Sediments

The sediment samples collected in 2001 represent the only data set for characterization of conventional (Table 4-9) and trace metal and organic compound concentrations (Table 4-6) in the pond sediments. The pond sediments have relatively uniform percent solids composition ranging from 36% to 58% solids, indicating a moderate organic matter content (refer to Table 4-9). The organic nitrogen content is considerable and phosphorus content is relatively low. Analysis for chloride indicates that all of the ponds have elevated salt content within the sediment structures.

Five sediment surface grab samples were collected and analyzed for total salinity content from Pond 7 (2 samples in March 2002 and 3 samples in May 2002) and

Table 4-9. Average Concentrations of Conventional Constituents in the Salt Pond Sediment Samples

Parameter (units)	Pond 1	Pond 1A	Pond 2	Pond 2A	Pond 3	Pond 4	Pond 5	Pond 6	Pond 6A	Pond 7	Pond 7A	Pond 8
~~**Inorganic constituents and trace metals**~~												
pH	7.70	8.25	7.70	6.95	8.13	7.73	7.85	7.87	7.47	6.87	7.30	5.97
Total phosphorus (mg/kg)	124	114	87.8	340	242	182	205	150	257	64.0	183	57.3
Chloride (mg/kg)	21,300	53,300	22,100	20,100	43,200	308,000	176,500	129,300	54,870	219,30 0	83,100	170,300
Organic nitrogen (mg/kg)	1,855	3,140	2,012	3,165	2,278	2,845	5,430	3,270	4,798	2,003	4,797	1,393
Total solids (%)	43.4	35.8	46.4	37.3	48.2	48.5	45.3	39.8	41.6	58.9	44.6	57.6
Sodium (mg/kg)	17,600	34,800	17,800	15,100	28,800	172,500	73,450	70,850	33,700	73,200	49,400	54,700
Potassium (mg/kg)	5,965	6,780	6,060	5,225	5,880	4,803	6,815	5,648	5,293	9,757	5,697	12,000

Notes:
mg/kg = milligrams per kilogram; µg/kg = micrograms per kilogram.
Source: Hydroscience 2002

three sediment samples were collected from Pond 8 in May 2002 (Gaia Consulting 2002). The sediment cores were generally about 7 to 12 inches long and consisted of dark brown silty sand. There was a salt crust approximately ¼-inch thick on the sediment surface of both ponds. Replicate pond brine samples were collected from the ponds at the same time as the sediment samples. Sediment salinity was determined by repeatedly extracting the samples with water to remove all soluble compounds. The data indicate that the salt content of the near surface sediment contains a lower mass of the total pond salt content than brine overlying the sediment. Sediment salinities ranged from 67 g/kg to 99 g/kg for Pond 7, and from 64 g/kg to 110 g/kg for Pond 8. Brine salinities at Pond 7 were 300 g/kg and 310 g/kg for April 19 and May 14, respectively. Salinities at Pond 8 were 140 g/kg and 190 g/kg on May 1 and May 14, respectively.

Pond sediment concentrations of specific trace metals and organic compounds compared closely with values measured in the Napa River and San Pablo Bay with differences generally being less than 50% of each other. There are no long-term geochemical cycling data available with which to evaluate the factors associated with the differences. Average selenium concentration values in the ponds are consistently higher than the respective Napa River and San Pablo Bay values. Concentrations of the majority of constituents in Ponds 4, 5, 6, 6A, 7, 7A, and 8 all appear to be slightly lower than concentrations in the Napa River or San Pablo Bay. Concentrations of constituents in Ponds 1 through 3 are similar or slightly higher than in the Napa River or San Pablo Bay. The detection limits for total PCBs, PAHs, and DDTs used for the pond samples were elevated relative to the criteria, so comparisons with the historical Napa River and San Pablo Bay data are only possible where detections occurred.

Analyses indicate the majority of pond sediments have relatively elevated selenium and total DDT content relative to the San Francisco Bay RWQCB sediment screening criteria for wetland noncover applications. Average concentrations of selenium exceeded the wetland noncover screening criteria in Ponds 2A, 3, 5, and 6A and single sediment sample values from Ponds 1, 1A, and 7A also exceeded the criteria, indicating that these sediments exceed criteria for use in wetland environments. The average concentration of zinc measured in Pond 7 also exceeded the wetland noncover screening criterion. The number of individual organic compounds detected and their measured concentrations were relatively low, with the exception of total DDT compounds. Average concentrations of total DDT did not exceed wetland noncover criteria. However, average DDT values did exceed the wetland cover criteria in Ponds 2A, 5, and 7A indicating that these sediments would be classified as being suitable only for wetland noncover uses. The average DDT values also exceeded the ER-L criteria in all ponds where detections occurred (Ponds 1, 2A, 4, 5, 6, and 7A) with the exception of Pond 3. However, DDT concentrations at the Napa River and San Pablo Bay sites also exceeded the wetland cover and ER-L criteria for DDT and indicate a regional presence of these compounds in the sediments. There were no pond average concentrations of mercury exceeding the either wetland use criteria; however, single sediment samples in Ponds 1 and 3 exceeded the wetland cover criteria. Average mercury values also exceeded the ER-L criteria in Ponds 1, 1A, 2A, 3, and 6A. Average arsenic values exceeded the ER-L

criteria in all ponds except Pond 4. Arsenic concentrations in the Bay Area soils are naturally elevated compared to screening criteria.

4.1.4.7 Treatment Plant Discharge

SVCSD currently produces disinfected secondary treatment water, but plans are underway to upgrade the WWTP to tertiary treatment in the next several years~~by summer 2004~~. SVCSD discharges water to Schell Slough during the wet season and stores water during the dry season for agricultural irrigation and environmental use. SVCSD created the Schell Slough Mitigation and Enhancement Wetland Area for constructing dry-season storage. During September and October, SVCSD provides secondary treated wastewater to flood these wetlands for winter habitat. If the project is implemented, SVCSD must continue to provide water to the wetlands and its current agricultural customers.

During the wet season, NSD produces secondary treated wastewater and discharges that water into the Napa River. Discharge into the Napa River is prohibited during the dry season, so NSD either puts the water through an additional filtration process to produce tertiary treated recycled water for reuse or stores it in holding ponds until the wet season when it can be discharged into the Napa River.

CAC WWTP discharged via NSD prior to becoming permitted by the San Francisco RWQCB in the fall of 2002. Now, CAC WWTP produces tertiary treated wastewater and discharges to North Slough, a constructed wetland on North Slough, or to recycled water customers.

4.2 Environmental Impacts and Mitigation Measures

4.2.1 Methodology and Significance Criteria

The potential effects of habitat restoration on local and regional water quality were assessed qualitatively and quantitatively, based on a comparison between existing conditions, project construction, and projected postrestoration conditions with respect to

- temporary construction-related water quality impacts;
- project operations impacts (temporary and long-term changes to water and sediment quality within the salt ponds, Napa River, San Pablo Bay, and other water bodies that may be affected); and
- constituents of concern including temperature, salinity, suspended solids and turbidity, organic matter, nutrients and dissolved oxygen, inorganic and organic contaminants, and sedimentation.

Similarly, the potential effects of the Water Delivery Option were assessed qualitatively based on a comparison of existing conditions, project construction, and postproject conditions with respect to the issues identified above.

Preliminary 1-D numeric modeling has been conducted and results are available to identify the potential water quality changes in the ponds, Napa River, and San Pablo Bay associated with some of the restoration strategies. In addition, a 2-D model was~~is being~~ developed to specifically design restoration strategies that ensure adequate mixing and dilution of salts in the receiving waters. Results from the 2-D model were completed in December ~~are expected by early~~ 2003. The analysis is generally qualitative with appropriate mitigation measures used to ensure that final project designs protect water resources. Final project designs would be developed in conjunction with these modeling efforts.

Criteria based on the CEQA Guidelines were used to determine the significance of water quality impacts. The project would have a significant impact on water quality if it would

- violate any water quality standards or waste discharge requirements, or
- substantially degrade water quality.

4.2.2 No-Project Alternative

4.2.2.1 Impact WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water

Under the No-Project Alternative, the salt ponds would continue to be managed in their current state by DFG. Ponds 4, 5, 7, and 8 would continue to contain large amounts of dissolved and precipitated salts. Pond 7 in particular would continue to have a large residual mass of bittern and associated deposits of precipitated chemicals as the surface layer of the pond sediments. Because the San Francisco Bay region is in a seismically active area, the pond levees could catastrophically fail or the ponds could be inundated as a result of seismically induced seiche or tsunami, causing a large discharge of contaminants into the Napa River (as described in Chapter 8, "Geology and Soils").

It is also presumed that long-term exposure of levees to flooding and wave action, in combination with limited levee maintenance, would eventually result in levee failures. The resulting discharge would most likely result in substantial impairment of water quality in the form of a large and rapid increase in the concentrations of salinity, suspended sediment, and other contaminants. Depending on the location of levee breaches, water quality impacts could occur within the local sloughs, Napa River, and/or San Pablo Bay. Continual erosion or catostrophic destruction of the upper ponds could cause severe water quality impacts to adjacent Napa Slough because these ponds contain large amounts of salt and bittern that could be released, and the slough is small which limits tidal

water exchange and dilution of potential discharges compared to the much larger Napa River channel.

The duration of the impaired water quality and magnitude and extent of beneficial use impact on the aquatic ecosystem of the Napa River and San Francisco Bay is difficult to forecast. PWA's hydrodynamic model was used to evaluate potential salinity effects resulting from levee breaches and inundation occurring in Ponds 3 and 4 during high streamflow conditions in the Napa River. The data indicate that salinity at the breach would increase by up to 18 ppt during the first 24 hours. The maximum salinity increase would drop to approximately 12 ppt the second day. The near-field plume in the Napa River, where salinity would increase by more than 5 ppt as a result of this discharge, would last for about 2 weeks. Because the 1-D modeling assumes complete mixing within the Napa River, salinity could increase to a greater extent near the 50-foot wide levee breach in the mixing zone of pond water and Napa River water than indicated by the modeling results. No modeling was conducted for levee breaches at Pond~~s~~ 7~~, 7A, or 8,~~ where substantially higher salt concentrations exist.

In general, the magnitude of modeled changes in salinity in the Napa River is within the seasonal range of salinity changes that naturally occur in the estuary. However, if a catastrophic breach were to occur during a period when sensitive life stages of aquatic organisms were present, salinity changes within the Napa River could cause substantial adverse water quality impacts. Uncontrolled levee breaches at Pond 7~~along the upper ponds~~ would also have greater impacts than similar breaches along the lower ponds because of the much higher salinity and bittern content that would be discharged to receiving water. While unlikely, a catastrophic breach during the summer low-flow period when minimal freshwater dilution is available would also have greater impacts than modeled.

USGS started monitoring salinity and other water quality parameters soon after the ditches were created on Pond 3, collecting data within the pond and outside the ditches. Initial salinity within the sloughs was approximately 20 parts per thousand (ppt) and within the pond was approximately 60 ppt. ~~Pond salinity was still near 60 ppt and the ditches are having a very slow effect on salinity. No change in the salinity in the sloughs was initially detected within 5-20 feet of the ditches. In December 2002, after approximately 13 inches of rain and 3 months of tidal cycles, salinity in Pond 3 along a transect between the two ditches was approximately 12 ppt. Additional monitoring and sampling is planned for 2003.~~

Initially, salinity increases in South Slough were limited to a localized area near the original breach. In Pond 3, the water level rose because of tidal pumping, which altered salinity, temperature, DO and pH. However, the breaches' effects on the pond were limited until mid-December (December 13–20, 2002), when the combination of a large storm and high tides widened the breach to South Slough. Within 1 week of the storm, rainfall and increased tidal action lowered the salinity of the pond from 45 ppt to 20 ppt, the background level in the Napa River. There was no detectable increase in salinity downstream of the breaches in Mare Island Strait or in Carquinez Strait. However, a salinity pulse persisting for 10 days was detected on the edge of a barotropic convergence zone 6 km to the west of the South Slough breach, about half way between the Napa River and

Sonoma Creek. Because of dilution by slough water and continuing rain, the salinity at this location never exceeded 20 (which is equivalent to ambient summer conditions). (Schoellhamer pers. comm.).

The breach to South Slough has continued to widen to over 70 feet, and a scour hole has formed in the slough as much as 26 feet deep and 150 feet long to the east of the breach. The scour hole predominantly migrates eastward because flow rates east of the South Slough breach increased to as much as 160 m3/s (more than twice the flow rate than west of the breach) to accommodate the tidal prism of Pond 3. In Pond 3, borrow ditches and relict channels near the breach also have been scoured by this increased flow. Minimal erosion has occurred at the second breach at Dutchman Slough, and water exchanges at this location are minimal because the thalweg of this breach is higher than that of the breach to South Slough. (Schoellhamer pers. comm.).

However, catastrophic breaches of the ponds, particularly the upper ponds as described above, could result in water quality changes that would most likely exceed San Francisco Bay RWQCB thresholds for adverse impacts on beneficial uses of the receiving water; therefore, this impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

4.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

4.2.3.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities may cause temporary water quality impairment because disturbed and eroded soil, petroleum products, and miscellaneous wastes could be discharged to nearby water and/or drainage channels. If allowed to occur when sensitive organisms are present, discharges of soil and associated contaminants can cause adverse changes in turbidity, aquatic habitat sedimentation, or exposure to toxic substances. Construction materials such as fuels~~,~~ and oils~~, paints, and concrete~~ are potentially harmful to fish and other aquatic life.

The extent of potential environmental impacts depends on the erodibility of soil types encountered, type of construction practices, extent of disturbed area, duration of construction activities, timing of precipitation, and proximity to drainage channels. Construction during the winter rainfall season can also be problematic because of the increased potential for discharges of contaminated stormwater runoff from construction sites.

This option may also include the component of using recycled water from the NSD and SVCSD WWTPs for additional dilution water in the mixing chamber at

the upper ponds (7, 7A, and 8). See Section 4.2.7, "Water Delivery Option," for specific details of the potential construction-related impacts.

Discharge of contaminated stormwater would ~~constitutes~~ constitute a violation of the Basin Plan water quality objectives; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-1: Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices

The project sponsors will obtain authorization from the San Francisco Bay RWQCB to construct proposed elements of the project. As part of this application, the project sponsors will prepare a SWPPP and require all construction contractors to implement BMPs identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants such as fuel, oil, grease, paint, concrete, and other hazardous materials. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. Construction will be limited to the dry weather season to the maximum extent possible. The SWPPP will be prepared prior to the start of construction activities and prescribe site-specific implementation of BMPs to avoid and reduce waste discharges. The SWPPP will include BMPs that address the following general categories of erosion and runoff control:

- soil stabilization measures, such as preservation of existing vegetation and use of mulch or temporary plantings to minimize soil disturbance;
- sediment control measures to prevent disturbed soils from entering waterways;
- tracking control measures to reduce sediments that leave the construction site on vehicle or equipment tires;
- nonstormwater discharge control measures, such as monitoring water quality of dewatering operations and hazardous material delivery, storage, and emergency spill response requirements; and
- measures by the project sponsors to ensure that soil-excavation and movement activities are conducted in accordance with standard BMPs regarding excavation and dredging of bay muds as outlined in BCDC's bay dredge guidance documents. These include excavating channels during low tide; using dredge equipment, such as sealing clamshell buckets, designed to minimize escape of the fine grained materials; and testing dredge materials for contaminants.

The contractor will select specific BMPs from each area, with project sponsor approval, on a site-specific basis. The construction general contractor will ensure

that the BMPs are implemented as appropriate throughout the duration of construction and will be responsible for subcontractor compliance with the SWPPP requirements.

4.2.3.2 Impact WQ-3: Increase in Salinity in the Napa River

The project is specifically designed to introduce low-salinity water into the salt ponds to reduce the amount of accumulated salts in the ponds to manageable levels through tidal water exchange and dilution of the higher salinity water. The project would result in temporary discharges of accumulated salts into project area sloughs and the Napa River. Preliminary modeling indicates that dilution of the ponds to the objective levels could be achieved relatively quickly (within 24 months) for Ponds 3, 4/5, and 6/6A, but may take longer (3–4 years) depending on the actual rate of salt dilution achieved with the proposed modifications. Modeling of salinity reduction for the existing water in Ponds 7, 7A, and 8 indicates that complete salinity reduction to ambient concentrations may take 8 – 10~~30–50~~ years. Careful management of releases from the upper ponds because of their chemical content (high salinity, low pH, ion-specific characteristics of bittern) is also important for ensuring the avoidance of adverse impacts on aquatic habitat and organisms. Adverse water quality impacts could occur as a result of releases from the upper ponds if there is insufficient dilution capacity within the sloughs and the Napa River. Salinity could also continue to be generated as a result of resuspension and dissolving of encrusted salts that currently reside in sediment layers in the upper ponds.

During typical high winter streamflow conditions, the maximum salinity increase in the Napa River and the sloughs is expected to be small because of the low-salinity receiving water and large dilution capacity. Salinity reduction in the ponds during the summer low-flow season would have a greater potential to cause water quality impacts on receiving waters because the dilution capacity would be reduced compared to the winter season. Figures 4-6 and 4-7 show simulated average daily salinity in the Napa River for preproject conditions and for project components, showing that salinity reduction can be completed over approximately 24 months (Philip Williams and Associates 2002b). Figure 4-6 shows salinity in the Napa River during the period when salinity is reduced in Pond 3. Salinity increases by a maximum of about 5 ppt, with most changes less than 1 ppt. Figure 4-7 shows the maximum potential salinity changes during the period when Pond 4 outlets are operated and salinity is reduced in Ponds 5 and 6/6A. Average salinity increases by a maximum of about 3–5 ppt within the first 4 months, with changes dropping to less than 1 ppt after 4 months. Figure 4-8 shows simulated receiving water changes in Napa Slough resulting from discharges from the upper ponds through the mixing chamber. The data indicate that maximum salinity increases would be about 2–3 ppt. These simulated changes are less than the existing normal range of ambient salinity changes that can occur in the lower Napa River at any given time. However, during the period when salinity reduction is occurring, the frequency of salinity increases in receiving waters would be greater compared to current conditions because

salinity levels in pond discharges would be elevated compared to conditions in the river and sloughs.

Over the long term, receiving water impacts from salinity reduction in the ponds would cease because the saline water in the ponds would be diluted and some of the ponds (the ponds opened to tidal action) would eventually accrete with sediment and vegetation and revert to tidal marsh with ambient salinity regimes that are typical of the natural San Francisco Bay area wetlands. Salinities in managed ponds would be controlled to ensure they are at ambient or near ambient levels, and the resulting discharges are within permitted limits.

The potential salinity changes in the Napa River and sloughs are a significant issue with regulatory agencies for beneficial use attainment, and long-term compliance with the Basin Plan objectives. Water quality objectives could be exceeded; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-2: Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring

The project sponsors will design the project so that the timing of construction and the potential salinity impacts on the Napa River and sloughs resulting from project-related discharges will comply with WDRs issued by the San Francisco Bay RWQCB and stipulations imposed by other resource agencies (e.g., NMFS, USFWS). It is anticipated that WDRs issued by the San Francisco Bay RWQCB will require that discharges meet stringent water quality limits in the receiving waters for salinity, temperature, DO, and contaminant loads. The rate of project-related discharges of high salinity water may also need to be controlled under certain conditions to ensure that the water quality conditions in receiving waters are not impaired.

In general, project facilities will be constructed with the following design features and ongoing water quality monitoring to protect the aquatic resources of the Napa River and sloughs and maintain compliance with applicable project permit conditions.

- The near-field mixing modeling will be used~~completed~~ to aid in the design of effective outfall diffusers in the sloughs and Napa River~~ to ensure rapid and complete mixing of the discharges into the receiving water~~.
- Modeling will also be used to develop a restoration design of the facilities needed to effectively reduce the highly saline and bittern waters that are present in the upper ponds.
- ~~Tests will be conducted on precipitated salts within pond sediments to identify the rate at which they may dissolve when exposed to less saline water. This information will be used to refine the modeling of long-term~~

~~salinity reduction scenarios for ponds that have encrusted salts in the sediment.~~

- Flow control structures that allow passage of water between the salt ponds and provide for discharge of salts to the Napa River or sloughs will be controlled in accordance with modeling parameters. Water flow into~~, within,~~ and from the salt ponds will be carefully monitored for salinity to ensure that the salinity reduction is proceeding according to the established design parameters.

A comprehensive water quality monitoring program will be prepared and implemented for the duration of the salinity reduction process by the project sponsors in conjunction with the overall monitoring and operations and maintenance program for the ponds. The monitoring program will have well-defined data quality objectives, monitoring procedures, and data analysis and reporting protocols to ensure that project operations are controlled according to the WDRs. Monitoring at specific locations will be completed and phased out as each successive pond is restored and salinity has been reduced to ambient levels.

The monitoring may~~will~~ include continuous recording devices for key parameters and periodic grab samples for specific constituents of concern. Measurement of key continuous monitoring variables (flow, water level stage, salinity, temperature, and TSS/turbidity) may~~will~~ be implemented at several pond and receiving water locations to provide for real-time management of the discharges. Grab samples will be used to characterize long-term changes in other constituents of concern that might be identified by the resource agencies and could include DO, pH, or selected inorganic ions and trace metals. Aquatic toxicity tests will also be conducted on a periodic basis.

The monitoring program could include protocols for updating modeling information as monitoring data are accumulated and will be designed to reduce the frequency of monitoring efforts as the ponds are restored and salinity levels are reduced. Monitoring, and potentially modeling, will be used to adjust project operations if deemed necessary. At a minimum, monitoring objectives will be consistent with any specified monitoring required by resource agencies and will provide specific procedures for corrective action if the water quality monitoring indicates exceedance of permit conditions.

Finally, to ensure the maintenance of water quality and compliance with water quality standards—specifically, the Clean Water Act Section 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plan), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards)—DFG and the Corps will adhere to the permit issued by the San Francisco RWQCB on Waste Discharge Requirements and a Water Quality Certification that may include:

- discharge prohibitions,
- effluent limitations,
- receiving water limitations,

- general provisions,
- soil excavation and placement provisions,
- design provisions, and
- monitoring and reporting provisions.

4.2.3.3 Impact WQ-4: Increase in Conventional Constituents

The flushing of other conventional physical and chemical constituents from the salt ponds could temporarily degrade water quality in the lower Napa River and sloughs. Potential issues of concern include adverse changes in the concentrations of pH, temperature, TSS, DO, BOD, and biostimulatory nutrients (nitrogen and phosphorus). Resources that might be adversely affected include fish habitat and habitat for other marine and estuarine aquatic organisms. Some of the contaminants present in the ponds are potentially harmful to aquatic wildlife if the concentration and duration of exposure is sufficiently elevated above background conditions. Parameters such as DO may be sufficiently suppressed to cause short-term impairment of habitat.

Specific modeling of fate and transport characteristics of these constituents during salinity reduction operations has not been conducted. In general, the concentration differences of conventional constituents between the ponds and background receiving water are relatively low compared to the difference in salinity between the ponds and background receiving water. Therefore, careful management of the salinity reduction operations should result in relatively smaller increases in receiving water concentrations of conventional constituents. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. Therefore, this impact is considered significant.

Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Impact WQ-3.

4.2.3.4 Impact WQ-5: Discharges of Priority Heavy Metal and Organic Constituents in the Napa River and Local Sloughs

The discharge of inorganic salts and associated salinity changes in the Napa River, in combination with the elevated levels of trace metals (copper, nickel, and zinc), could result in discharges to the Napa River that exhibit chronic or acute toxicity to aquatic organisms as measured by EPA standardized testing procedures. As described for the conventional constituents, the relative concentration differences in constituents between the ponds and background

receiving water are relatively low compared to the same difference in salinity. Therefore, management of salinity should result in relatively greater dilution of the heavy metal and organic constituents to levels that would not adversely impact aquatic organisms. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. Therefore, this impact is considered significant.

Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Impact WQ-3.

4.2.3.5 Impact WQ-6: Increase in Contribution of Conventional Heavy Metal and Organic Constituents from Recycled Water

Recycled water would be used as dilution water for the mixing chamber and eventually be discharged to the Napa slough. Recycled water typically contains minerals, ammonia, nutrients, residual chlorine, and BOD. It is often less turbid with less temperature variation than natural surface receiving waters. ~~As described below, i~~If recycled water were used for dilution of high salinity waters in Pond~~s~~ 7~~, 7A, and 8,~~ the existing discharge of recycled water from the NSD, CAC, and SVCSD WWTPs would be put to the beneficial use of salinity reduction.

Chemical constituents in the recycled water could cause localized water quality changes in the receiving waters by imposing additional oxygen demand, stimulating algae growth, altering temperature, or otherwise modifying background water quality conditions. In particular, nutrients in recycled water have the potential to cause biostimulatory responses to biota in receiving water, such as growth of algae or vascular aquatic vegetation. Depending on the relative concentrations of the constituents in the recycled water and high-salinity ponds at the time of mixing, the concentrations discharged to the receiving water will vary.

The San Francisco Bay RWQCB prohibits surface water discharges of treated wastewater in the north bay region if initial dilution capacity of the receiving water is less than 10:1. Therefore, recycled water that is generated at the NSD and SVCSD WWTPs must currently be stored during the summer and discharged to surface receiving waters during the winter. However, RWQCB Resolution 94-086 would be applied because the recycled water would expedite habitat restoration in the upper ponds. It is likely discharge of recycled water used for diluting the high-salinity water contained in the upper ponds would be allowed during the summer. During the winter, the effects of project-related discharges of recycled water to the mixing chamber, ponds, and receiving waters would not be appreciably different than existing conditions because the discharges would occur as currently permitted by the San Francisco Bay RWQCB.

Discharges of recycled water could impair water quality in Pond 7 and the Napa Slough and therefore this impact is considered significant. Implementation of Mitigation Measure WQ-3 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-3: Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements

The project sponsors and SCWA will design the project to comply with RWQCB permitting requirements. The recycled water discharge to Pond 7 and the mixing chamber will be covered under an NPDES permit from the RWQCB. The recycled water monitoring program will include specific monitoring and data quality objectives to ensure that discharge of recycled water does not cause adverse water quality conditions such as eutrophication of receiving waters. Operation of the project may include seasonal limitations and specific restrictions on the quality and quantity of the recycled water discharges. Following successful salinity reduction and restoration of the ponds, recycled water would be applied to agricultural lands and any ongoing monitoring of recycled water discharges would be conducted by SVCSD, NSD, and CAC.

4.2.3.6 Impact WQ-7: Water Quality Changes in the Salt Ponds

Reduction of the ponds' existing high salinity is considered a long-term beneficial impact because the restoration would provide additional aquatic habitat. The highly saline upper ponds have limited aquatic diversity because only extremely tolerant organisms can survive in those conditions. Several of the lower ponds (particularly Ponds 4 and 5) have also recently provided limited habitat because of increasing salinities. Dilution of other adverse conditions (i.e., low pH, elevated concentrations of specific constituents) is also considered beneficial. Improved water quality within the ponds would increase aquatic habitat diversity and provide feeding and resting habitat for migratory shorebirds and waterfowl.

Over the long term, the opening of some of the ponds to natural tidal exchange with the Napa River could result in deposition of undesirable chemical constituents in the ponds. The Napa River and lower estuary contain trace metal and organic constituents, and exposure to aquatic organisms from these constituents could increase. However, in general the soluble concentrations of trace metal and organic compounds are higher in the ponds than in the Napa River or San Pablo Bay. Therefore, opening the ponds to tidal action will gradually reduce the elevated pond concentrations down to ambient background conditions. In a similar fashion, the existing pond sediment concentrations are similar or slightly lower than Napa River or San Pablo conditions. Consequently, pond sediment concentrations would be expected not to change or to increase slightly.

Mercury accumulation in the restored wetlands poses a concern because potential formation of methyl mercury is more likely in the chemically reducing conditions of shallow wetland sediments. The potential long-term impacts of bioaccumulation of mercury are not known but are likely to increase over existing levels; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-4 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-4: Monitor Pond Water Quality and Use Adaptive Management

The project sponsors will collect water quality and sediment samples periodically and for a sufficient duration to document that accumulation of trace metal and organic compounds does not occur in the restored wetlands. If sampling indicates adverse conditions may be occurring, the result of this data collection effort will be further reviewed by a scientific panel composed of USFWS, NMFS, DFG, the San Francisco Bay RWQCB, San Francisco Estuary Institute, and other groups. The panel will help identify the sources of the constituents and recommend corrective actions to the project sponsors. The project sponsors may implement corrective actions, which may include limiting future restoration efforts or implementing alternative management methods for restoration areas that reduce susceptibility to chronic bioaccumulation.

4.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-4, WQ-5, WQ-6, and WQ-7 because project-related construction and operation activities would be nearly identical. The primary difference for Option 1B would result from breaching Pond 3 levees to coincide with a period of high Napa River outflow. The breach would be designed to reduce the overall duration of the salinity reduction process in Ponds 3 through 6. Impacts WQ-2 and WQ-3 are slightly different under this option and are described below.

4.2.4.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities would generally result in temporary water quality impacts similar to those under Salinity Reduction Option 1A. However, the magnitude of the impacts could be greater because levees at Pond 3 would be breached during a high streamflow. The breach may be initiated with heavy earthmoving equipment and/or explosives and would be allowed to naturally erode. The use of explosives c~~w~~ould introduce suspended sediment into the Napa River at elevated concentrations compared to the background sediment transport in the streamflow. In addition, the quantity of large sediment particles that would not

be carried downstream as suspended sediment and thereby deposit near the discharge location may be sufficient to cover aquatic organism habitats. It is difficult to predict the extent of downstream sedimentation in the Napa River because modeling of sediment discharges has not been conducted and sediment mass transport would depend on the magnitude of Napa River flows and the tidal prism. It would be expected that suspended sediment transport and channel sedimentation patterns would return to normal in a relatively short time period as natural flows would tend to transport the material downstream. ~~With the exception of large rocks, f~~Flow in the Napa River would eventually reduce and eliminate above grade deposits of large sediment particles near the breach as erosive forces continue to dislodge and transport the material downstream. Mechanical removal of the levees would result in much less impact from instream sediment discharges because it would be either placed within the confines of the ponds or removed.

Regulatory water quality objectives for turbidity and sediment could be exceeded as a result of the mechanical removal of levees; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," and Mitigation Measure WQ-5, "Prepare Levees and Time Breaches," would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-5: Prepare Levees and Time Breaches

The project sponsors will minimize the amount of sediment discharged into the water to the extent possible by preparing the levees for breaching by removing excess material from the levees before the winter season. They will evaluate storm event activity and tidal cycles and initiate the breaching at the time of optimal available quantities of Napa River flow to sufficiently dilute the discharge (i.e., during the peak streamflow and high tide periods). Levees will be breached during the flood tidal cycle to maximize the amount of sediment transported inward to the ponds.

4.2.4.2 Impact WQ-3: Increase in Salinity in the Napa River

This option would accelerate the rate of salinity reduction in Pond 3 as the Napa River levee in Pond 3 would be breached during a high streamflow event. This option would use the large dilution capacity present within the Napa River when high winter flows occur. Salinity reduction in the upper ponds would occur as described for Salinity Reduction Option 1A; the potential water quality impacts would be identical. Numeric water quality modeling of this specific scenario indicated that salinity downstream of the breach would temporarily rise by approximately 7 ppt and be reduced quickly (i.e., within about 2 days) to within 5 ppt of background conditions existing before the breach (Philip Williams and

Associates 2002b). The modeling results indicated that elevated salinity conditions would probably be present for less than 1 month until salinity in the pond was completely diluted by tidal exchange.

The Basin Plan water quality objective for salinity is narrative and specifies that salinity from controllable discharges be limited to ensure that beneficial uses are not impaired. The salinity increase would be slightly larger than daily fluctuations and sudden; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-4, WQ-5, WQ-6, and WQ-7 because project-related construction and operation activities would be nearly identical. The primary difference for Option 1C would result from creation of ~~additional~~ levee breaches at Ponds 3 and 4/5 to coincide with a period of high Napa River outflow. The breaches would be designed to reduce the overall duration of salinity reduction in Ponds 3 through 6. Impacts WQ-2 and WQ-3 are slightly different under this option and described below.

4.2.5.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

The short-term construction-related water quality impacts of Salinity Reduction Option 1C would be slightly larger than those of Salinity Reduction Option 1B because a greater amount of ground disturbance would occur, ~~particularly~~ in association with the planned levee breaches. Using explosives to breach~~destroy~~ the levees would cause large amounts of suspended sediment and turbidity to be introduced into the stream, potentially causing temporary sedimentation of aquatic habitat. Though this would occur when the Napa River already has elevated suspended sediment and turbidity due to storm events, t~~T~~his impact is considered significant. Implementation of Mitigation Measures WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," and WQ-5, "Prepare Levees and Time Breaches," would reduce this impact to a less-than-significant level. These measures are described under Salinity Reduction Options 1A and 1B, respectively.

4.2.5.2 Impact WQ-3: Increase in Salinity in the Napa River

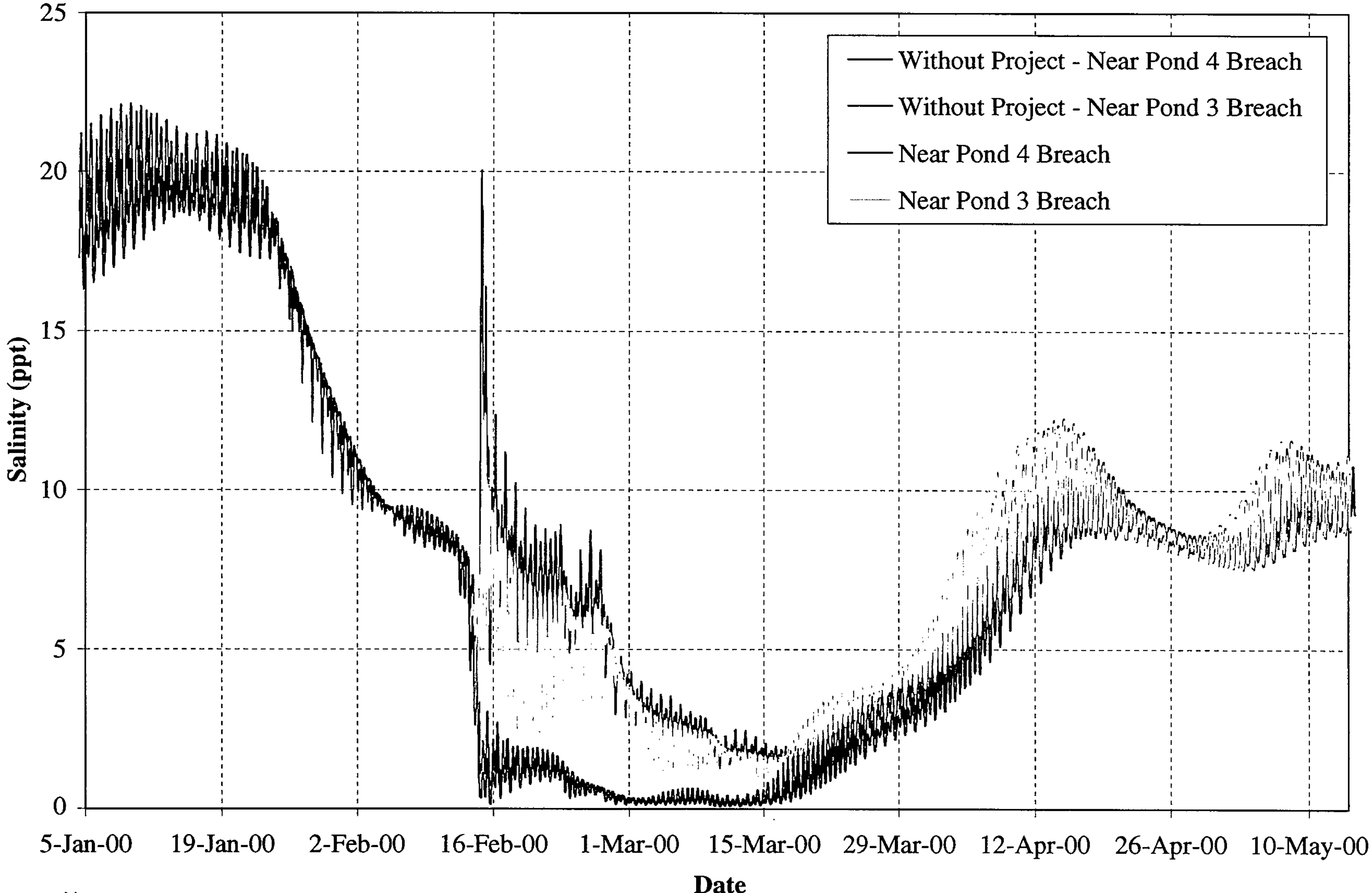
This option would greatly accelerate the rate of salinity reduction in Ponds 3 and 4/5 as the Napa River levees in Ponds 3 and 4/5 would be breached during a high streamflow event. Salinity reduction in the upper ponds would occur as described for Salinity Reduction Option 1A; the potential water quality impacts would be identical. Figure 4-9 shows simulated change in average daily salinity in the Napa River for preproject conditions and during the first 6 months following levee breaching. The data indicate that salinity in the Napa River would decrease substantially because of storm events, then salinity at the breach would increase by up to 18 ppt during the first 24 hours. The maximum salinity increase would drop to approximately 12 ppt the second day and to a differential of less than 5 ppt within 2 weeks. The change in salinity is within the range of normal variation in the river; however, the rate of change would be greater than under normal conditions. It should be noted that the modeling assumed that Ponds 3 and 4 would be breached at the same time; this would overstate the expected salinity increase associated with the proposed phased breaches. The salinity increase would be large and sudden; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-2, WQ-5, and WQ-7. Impacts WQ-3, WQ-4, and WQ-6 are slightly different and are described below.

4.2.6.1 Impact WQ-3: Increase in Salinity in the Napa River, Salt Ponds 1/1A and 2, and San Pablo Bay

Salinity reduction under Salinity Reduction Option 2 would result in discharges of highly saline water to the Napa River and San Pablo Bay. Figure 4-10 shows the simulated change in average daily salinity in the Napa River for preproject conditions. Modeled data, when compared to existing conditions, indicate that salinity in the Napa River would increase by about 1 ppt. The potential salinity increase in San Pablo Bay is also expected to be small because ambient salinity conditions in the bay are higher than in the Napa River and the extended route of travel time through the ponds would provide a large dilution capacity for existing salts. However, water quality could be substantially degraded in Ponds 1, 1A, and 2 compared to existing conditions by diluting and mixing bittern in these ponds. Bittern dilution would occur at approximately 1:40 or 2 to 2.5 times the



Notes:

Salinity in Napa River as simulated by MIKE 11.
Data extracted from Napa River near breaches.
Values are sectionally averaged.
Ponds 3 and 4 are breached on February 16.

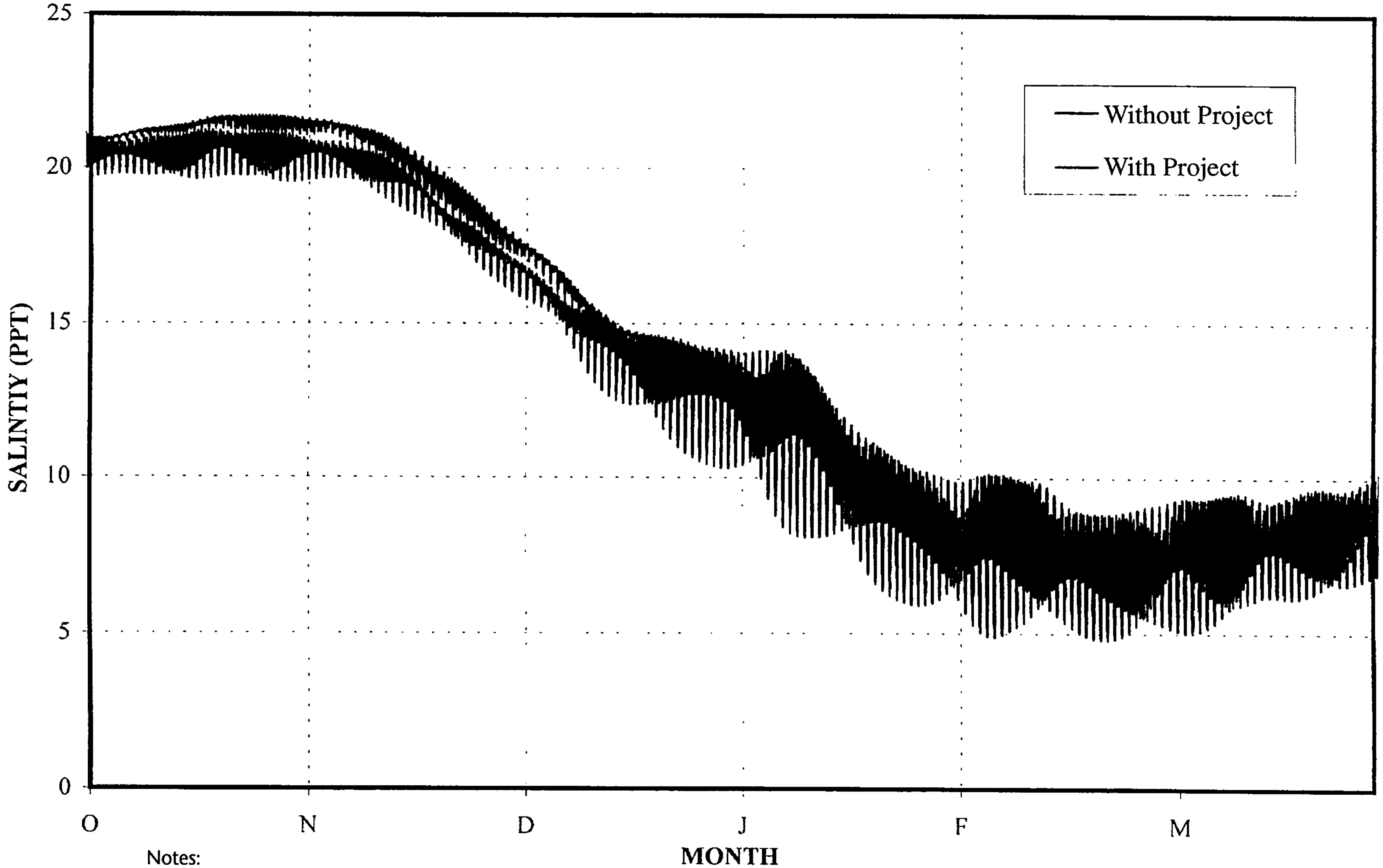
Simulated project-related impacts are highest during the first month of the project and decrease as salinity in Ponds 3 and 4 approach ambient levels. Impacts in the Napa River near Pond 3 are mostly relative to discharge from Pond 4 breach traveling downstream.

Source: Philip Williams Associates 2002

01396.01

Jones & Stokes
PWA

Figure 4-9
Salinity Reduction Option 1C – Salinity in Napa River near Breaches



Notes:

Salinity in Napa River as simulated by MIKE 11.
Data extracted from Napa River near Pond 3 Outlet.
Values are sectionally averaged.
Simulated project-related effects are highest during the first 2–3 months of the project and decrease as Pond 3 salinity approaches ambient levels.

Source: Philip Williams Associates 2002

01396.01

Jones & Stokes
PWA

Figure 4-10
Salinity Reduction Option 2 – Salinity in Napa River near Pond 3 Outlet

allowable open water discharge concentration (PWA 2002b). Discharges to San Pablo Bay would have higher salinity than under existing conditions and could also have elevated levels of bittern. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce the impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6.2 Impact WQ-4: Increase in Conventional, Trace Metal, and Organic Constituents

This impact would be nearly the same as that under Salinity Reduction Option 1A except that San Pablo Bay (instead of Napa Slough) would receive discharged water. As described under Salinity Reduction Option 1A, the concentration differences of conventional and priority trace metal and organic constituents between the ponds and background receiving water are relatively low compared to the difference in salinity. Therefore, careful management of the salinity reduction operations should result in relatively smaller increases in receiving water concentrations of conventional constituents. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. This impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6.3 Impact WQ-6: Increase in Contribution of Conventional, Trace Metal, and Organic Constituents from Recycled Water

This impact is nearly the same as that under Salinity Reduction Option 1A except that some of the lower ponds (Ponds 1, 1A, 2, 6, and 6A) and San Pablo Bay would receive recycled water. Nutrients (nitrogen and phosphorus) could stimulate algae and vascular aquatic vegetation growth in the lower ponds because the ponds would be relatively shallow, receive adequate light, and have warm water temperatures; however, the overall risk of large-scale eutrophication appears to be low based on a study of the Hudeman Slough wetlands (SCWA 2003). It is anticipated that chemical constituents would be diluted substantially because of the large volume of water and dilution capacity in the ponds. Use of recycled water to restore the natural salinity patterns in the salt ponds is particularly applicable under the RWQCB Resolution 94-086 to restore and enhance wetlands when initial dilution capacity of the recycled water is limited. However, this impact is still considered significant. Implementation of Mitigation Measure WQ-3, "Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements," would reduce this impact to

a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.7 Water Delivery Option

4.2.7.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Water Delivery Project Component

Construction of the Sonoma Pipeline could cause water quality impacts primarily because sediment from disturbed soils could erode into local waterways and other pollutants from construction activities could enter local watercourses. Construction of the pipeline would disturb soil in the construction easement surrounding the pipe (approximately 30 feet wide) and the staging areas where contractors store supplies. Approximately 16 acres of soil would be disturbed along the entirety of the pipeline construction route. Pipeline construction would proceed along the route in an incremental manner with the active construction area being 30 feet wide and 200–300 feet long. As such, the area with the greatest potential for erosion and sedimentation impacts at any given time during pipeline construction would be approximately 0.14–0.20 acre, or double that amount if work were proceeding simultaneously at two sites.

The disturbed soils would be reseeded or repaved as part of the construction project, so there would be no long-term impacts. However, during the construction process, precipitation could produce stormwater runoff that contains elevated levels of sediment, which would exacerbate sedimentation concerns in area rivers and creeks. Additional sediments or pollutants could be eroded into local waterways as a result of water used during the construction process.

Construction practices have the potential to pollute waterways. The following activities that could occur on the construction sites for the Water Delivery Project Component have the potential to allow pollutants to enter watercourses: dewatering; paving; material delivery, storage, and material use; contaminated soils/water removal; concrete or asphalt waste removal; vehicle/equipment cleaning; vehicle/equipment fueling; and vehicle/equipment maintenance.

Construction of the Sonoma Pipeline could require construction dewatering during excavation for, and placement of, the pipelines. Similarly, excavation and use of pipeline jacking and receiving pits at the crossing of Huichica Creek or the unnamed creek could require temporary dewatering. The groundwater in the pipeline vicinity is generally of good quality, although it has some localized areas of increased salinity or boron concentrations. The water would be discharged into nearby drainage areas, which could potentially transfer boron or salinity into area waterways.

The construction of the Napa Pipeline would occur in a manner similar to that described above for the Sonoma Pipeline. Given that the Napa Pipeline is shorter than the Sonoma Pipeline, implementation of the Napa Pipeline project would disturb less acreage, approximately 11 acres, and would result in fewer potential water quality impacts similar than those described for the Sonoma Pipeline.

Construction of the CAC Pipeline would occur in a manner similar to that described above for the Sonoma Pipeline. Given that the CAC Pipeline is shorter than the Sonoma Pipeline, implementation of the CAC Pipeline project would disturb less acreage, approximately 7 acres. The CAC Pipeline therefore would result in fewer potential water quality impacts than those described for the Sonoma Pipeline.

This impact is considered significant. Implementation of Mitigation Measure WQ-6 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-6: Prepare and Implement Storm Water Pollution Prevention Plans

The contractor will complete and implement a SWPPP to describe construction site characteristics and identify the BMPs that should be applied to each site. The SWRCB has established a list of construction BMPs that help owners and contractors understand the BMPs that could be helpful on each site.

For the currently proposed pipelines, implementing BMPs from the following groups would mitigate potential impacts:

- soil stabilization measures, such as preserving existing vegetation and use of mulch or temporary plantings, to minimize soil disturbance;
- sediment control measures to prevent disturbed soils from entering waterways, including silt fences around disturbed areas and straw bales around drainage areas;
- tracking control measures to reduce the amount of sediment leaving the construction site on vehicle or equipment tires; and
- nonstormwater measures, such as monitoring water quality of dewatering operations and material delivery and storage requirements to reduce spills, to decrease other sources of pollutants.

The contractor will select specific BMPs from each area, with project sponsor~~owner~~ approval, on a site-specific basis. The contractor will then include a site description and the appropriate BMPs in a SWPPP. The general contractor will ensure that the BMPs are implemented as appropriate throughout the duration of pipeline construction and will be responsible for subcontractor compliance with the SWPPP requirements.

Water Delivery Program Component

While the exact alignments and construction methods have not yet been determined for the Program Component of the Water Delivery Option, the overall construction-related impacts of the Program Component (i.e., potential future pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs) would be comparable to those described above for the Water Delivery Project Component based on similarities in the basic nature and design of the pipelines. This impact is considered significant. Implementation of Mitigation Measure WQ-6, "Prepare and Implement Storm Water Pollution Prevention Plans," would reduce this impact to a less-than-significant level. This measure is described under "Water Delivery Project Component" above.

4.2.7.2 Beneficial Impact WQ-8: Long-Term Changes to Water Quality in Local Rivers and Salt Ponds from Project Operations

Water Delivery Project Component

SVCSD currently discharges treated wastewater into area waterways during the wet season. SVCSD will add the Napa River Salt Marsh Restoration Project as a point of discharge. However, SVCSD will continue to discharge treated wastewater from the Schell Slough location in case of emergencies or operational problems with the proposed project. The reclaimed water would then be mixed with water from Ponds 7, 7A, and 8, and the newly mixed water would then be discharged to ~~the~~ Napa Slough~~River~~. Potential effects of this new discharge pattern are also discussed under Impact WQ-6 above. After the pond restoration is complete, the reclaimed water would be used for agricultural irrigation during the summer. This next step would reduce or eliminate discharge into the San Pablo Bay system. The recycled water currently contains low levels of copper and mercury, which are both listed as San Pablo Bay contaminants on the 303(d) list. Reducing discharge that contains these metals would help the north bay region achieve the levels set as part of the TMDL process. In addition, projects that use wastewater effluent for the restoration and enhancement of wetlands may be considered for implementation under RWQCB Resolution 94-086 provided that a net environmental benefit can be justified. This impact is considered less than significant, and, in some respects, may be beneficial; therefore, no mitigation is required.

NSD and CAC WWTPs discharge treated wastewater into the Napa River during the wet season and CAC WWTP discharges to North Slough, and portions of these discharges would also be relocated to the Napa River Unit for the duration of the restoration effort. After the restoration, the reclaimed water would be also used for agricultural irrigation. This impact is considered less than significant, and, in some respects, may be beneficial; therefore, no mitigation is required.

Water Delivery Program Component

Similar to the Water Delivery Project Component, under the Water Delivery Program Component, sanitary districts' discharge points would be moved from local waterways within the San Pablo Bay watershed to the Napa River Unit. The City of Petaluma discharges into the Petaluma River, Novato SD discharges into San Pablo Bay, and LGVSD discharges into Gallinas Creek. Reducing treated wastewater discharges into these rivers and creeks would have impacts similar to those described above for the Water Delivery Project Component. This impact is considered less than significant. No mitigation is required.

4.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-5 and WQ-6. Impacts WQ-2, WQ-3, WQ-4, and WQ-7 are slightly different and are described below.

4.2.8.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

The types of short term and intermittent construction-related impacts of levee breaches would be similar to those described under Salinity Reduction Option 1A, except that numerous additional breaches would be implemented for Ponds 3, 4, and 5. Extensive construction grading and earthmoving operations would also occur to lower levees and create starter channels in the areas slated for tidal marsh. The construction would occur over a longer time period and facilities would be constructed adaptively only as restoration goals are achieved. Additional construction would be required for extensive levee repairs and maintenance activities that are considered necessary for some of the ponds. Also, most construction would occur before the ponds are breached or away from existing breaches (at Pond 3). ~~For example, c~~Construction of facilities for habitat restoration at Ponds 6/6A would not occur for many years (until Ponds 3, 4, and 5 are sufficiently restored). Sediment discharge quantities and discharge rates into receiving waters could be minimized because construction operations would occur over several construction seasons, would occur over large areas in different regions of the pond system, not occur all at the same time, and generally be conducted in areas that are distant from direct exposure to the adjacent river and slough channels. The total mass of sediment entering receiving waters would probably be larger than described for salinity reduction options alone, however, it is expected that a majority of the material would likely settle within the pond system and not result in direct discharges to the adjacent channels.

This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement

Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A. In addition, the levee breaches, levee lowering, levee repair, and starter channel construction activities should be designed to minimize sediment discharge to receiving waters to the extent possible. Implementation of Mitigation Measure WQ-5, "Prepare Levees and Time Breaches," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

4.2.8.2 Impact WQ-3: Increase in Salinity in the Napa River

This impact to salinity conditions in the ponds and adjacent channels would depend on the specific elements of salinity reduction procedures that are implemented. Salinity reduction for this alternative would most likely consist of either Salinity Reduction Option 1A, 1B, or 1C. Habitat restoration would be implemented following reduction in salinity and habitat restoration procedures would not specifically change the pattern of salinity impacts to receiving waters as they are described above. Over the long-term, salinity in the managed ponds would still have the potential to develop adverse salinity concentrations as evaporation from the water surface and evapotranspiration through plants occurs. In the absence of careful management of water exchange operations, these ponds could continue to exhibit adverse impacts to the biota that currently inhabit or become established following restoration.

Therefore, this impact is still considered significant. Implementation of Mitigation Measures WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.8.3 Impact WQ-4: Increase in Conventional, Trace Metal, and Organic Constituents in the Napa River

As described above, Habitat Restoration Option 1 would have water quality impacts for conventional and priority trace metal and organic constituents that depend on the specific salinity reduction option that is implemented. Habitat restoration options would not have specific additional impacts, however, construction related disturbances of sediment contained within the ponds may contribute additionally to discharges to receiving waters as construction occurs for levee lowering, berm and ditch blocks, and starter channels. This impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.8.4 Impact WQ-7: Water Quality Changes in the Salt Ponds

As described under Salinity Reduction Option 1A, managed ponds would be exposed to sedimentation associated with suspended sediments in tidal exchange water. Ponds would also be exposed to a host of conventional inorganic constituents, trace metals, and organic compounds associated with tidal exchange water and recycled water. However, habitat restoration elements are not expected to cause explicit additional impacts in the ponds from chemical constituents. This impact is considered less than significant.

4.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 are nearly the same as those under Habitat Restoration Option 1 for Impacts WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7. Impact WQ-2 is slightly different and is described below.

4.2.9.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

This impact is nearly the same as that under Habitat Restoration Option 1. A new levee within Pond 2 under this option would require additional inwater construction compared with Habitat Restoration Option 1. Considerably more construction would occur under this alternative for levee lowering and starter channel construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts WQ-2, WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7) are nearly the same as those described under Habitat Restoration Option 1. Slightly less short-term construction related impacts would occur because the extent of construction for levee removals, ditch blocks, and starter channels would be less.

4.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 are nearly the same as those under Habitat Restoration Option 1 for Impacts WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7. Impact WQ-2 is slightly different and is described below.

4.2.11.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities for Habitat Restoration Option 4 would result in similar temporary water quality impacts similar to those for the other habitat restoration options. However, the increased number/extent of habitat restoration features would result in a longer duration of construction and would require a greater amount of construction, increasing the possibility of construction-related water quality impacts. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would still protect water quality and would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A. The additional protections described under Habitat Restoration Option 1, for any levees that are breached using explosives, would also be implemented to minimize potential downstream sedimentation impacts.

Chapter 5
Biological Resources—Vegetation

5.1 Environmental Setting

5.1.1 Introduction and Sources of Information

This chapter describes the natural vegetation communities and plant species in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information on existing conditions is derived primarily from the following:

- *Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements for Key Plants, Fish, and Wildlife* (Goals Project 2000);
- *Baseline Monitoring of the Pond 2A Tidal Restoration Project* (MEC Analytical Systems 2000);
- *Napa Salt Ponds Biological Resources* (Lewis Environmental Services and Wetlands Research Associates 1992);
- *The Natural Resources of Napa Marsh; Coastal Wetland Series #19* Madrone Associates 1977);
- *San Pablo Bay Watershed Restoration Framework Program Final Report* (Camp Dresser & McKee 2000);
- *North Slough Marsh Restoration Project Conceptual Plan* (Environmental Science Associates 2000);
- *Status and Trends Report on Wildlife of the San Francisco Estuary* (U.S. Fish and Wildlife Service 1992);
- *State of the Estuary* (Association of Bay Area Governments 1992);
- Draft Subsequent Environmental Impact Report, March 1986, Wastewater Reclamation and Disposal Facilities (Landon, Wheeler, and Weinstein 1986);
- Stanly Ranch Specific Plan Draft EIR (Brady/LSA, August 1998), and;
- Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration (Napa Sanitation District, January 11, 1995).

Several sources were consulted to develop a list of special-status plant species that may occur in the project area or vicinity and that may be affected by the proposed project or options. Sources consulted include the documents listed above and the following:

- *Species List for the Napa River Salt Pond Restoration Project, Napa and Solano Counties, California* (U.S. Fish and Wildlife Service 2001);
- *Rarefind2: California Natural Diversity Database* (California Department of Fish and Game 2001); and
- Electronic Inventory of Rare and Endangered Vascular Plants of California, 6th Edition (California Native Plant Society 2001).

The DFG California Natural Diversity Database (CNDDB) and the California Native Plant Society (CNPS) Electronic Inventory are databases of reported occurrences of special-status plants and sensitive communities. To enable development of a list of species that may occur in the project area, a search of the latest versions of each database was conducted for reported species occurrences in the USGS 7.5-minute topographic quadrangles, showing the project area and all adjacent quadrangles. Only species from these lists and the list provided by USFWS that are known to occur in the habitat types found in the project area were considered to have potential to occur in the project area and be affected by project-related activities.

5.1.2 Regulatory Setting

Several federal and state agencies have regulatory authority or responsibility over project-related activities that affect biological resources. This section describes the federal and state policies and laws relevant to biological resources in the project area. Table 5-1 summarizes project-related activities, the type of resource affected, and the government agency with regulatory authority over the activity.

5.1.2.1 Federal

Endangered Species Act

Section 7 of the federal Endangered Species Act (ESA) of 1973, as amended (16 USC 1531), requires that all federal agencies consult with USFWS and NMFS if they determine that a proposed project may affect a listed species or its habitat. The purpose of consultation with USFWS and NMFS is to ensure that the federal agencies' actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species. USFWS (with jurisdiction over plants, wildlife, and resident fish) and NMFS (with jurisdiction over anadromous fish and marine fish and mammals) oversee ESA.

Table 5-1. Summary of Regulatory Setting for Vegetation Resources

Project-Related Activity	Regulatory Authority
■ Dredging or discharge of fill into wetlands or waters of the United States; ■ levee breaches; ■ structures in streams or wetlands (e.g., tide gates); and ■ other permanent or temporary alteration to wetlands.	The Corps, permitting authority under Section 404 of the CWA
■ Alteration of stream channel, bed, or bank, including dredging or discharge of fill	DFG, permitting authority under Section 1601 (Lake or Streambed Alteration Agreement) of the California Fish and Game Code
■ Alteration of navigable waters or tributaries and wetlands adjacent to navigable waters	The Corps, permitting authority under Section 10 of the RHA
■ Effects on species or the habitat of species listed or candidates for listing under ESA	USFWS and NMFS, formal consultation and permitting authority under Section 7 of ESA
■ Effects on species or the habitat of species listed or candidates for listing under CESA	DFG, consultation and permitting authority under Section 2081 of CESA
■ Effects on plants listed as rare under the California Native Plant Protection Act (CNPPA)	DFG, reporting and consultation requirement
■ Effects on wetlands	DFG, permitting authority under Section 30411 of the California Coastal Act and California Wetlands Conservation Policy
■ Effects on other special-status species, including species of concern and CNPS-listed plants	DFG and USFWS, responsible agencies to review EIR and EIS

Under Section 9 of ESA, the take prohibition applies only to wildlife and fish species. However, Section 9 does prohibit the unlawful removal and reduction to possession, or malicious damage or destruction of, any endangered plant from federal land. Section 9 prohibits acts to remove, cut, dig up, damage, or destroy an endangered plant species in nonfederal areas in knowing violation of any state law or in the course of criminal trespass. Candidate species and species that are proposed or under petition for listing receive no protection under Section 9.

Section 10 of ESA requires the issuance of an incidental take permit before any public or private action may be taken that would potentially harm, harass, injure, kill, capture, collect, or otherwise hurt (i.e., take) any individual of an endangered or threatened species. The permit requires preparation and implementation of a habitat conservation plan (HCP), incidental to implementation of the project, which would offset the take of individuals that may occur by providing for the overall preservation of the affected species through specific mitigation measures.

The project sponsors have~~will~~ prepared a biological assessment for submission to USFWS and, based on the information in this report, USFWS ~~will~~ has prepared a biological opinion (BO) on the proposed project. The BO indicates that USFWS believes that the project will not jeopardize any listed species in the project area (a "No Jeopardy classification").

Clean Water Act Section 404

The Corps and EPA regulate the discharge of dredged or fill material into wetlands and other waters of the United States under Section 404 of the CWA. *Waters of the United States* include wetlands and lakes, rivers, streams, and their tributaries. *Wetlands* are defined for regulatory purposes, at 33 CFR 328.3 and 40 CFR 230.3, as areas

> inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Project proponents must obtain a permit from the Corps for all discharges of fill material into waters of the United States, including wetlands, before proceeding with a proposed action. Actions typically subject to Section 404 requirements are those that would take place in wetlands or channels conveying natural runoff, including intermittent streams, even if they have been realigned. Artificial channels that convey only irrigation water usually are not included. Section 404 regulates any discharge activity below the ordinary high-water level—the water level with a flow equal to the mean annual flood—of a stream channel. Examples of such discharge activities include placement of fill material, placement or alteration of structures that have the intended effect of functioning as fill, or any discharge activity that would affect wetlands or the surface-water conveyance or capacity of a channel.

A federal ruling issued in 2001 may affect whether wetlands are considered jurisdictional by the Corps (January 9, 2001, Solid Waste Agency of Northern Cook County [SWANCC] ruling [*SWANCC* v. *United States Army Corps of Engineers* (121 S.Ct. 675,2001)]). Guidance on nonnavigable, isolated and intrastate waters was published on January 19, 2001, by counsel for EPA and the Corps in response to the SWANCC ruling. The guidance essentially resulted in the determination that nonnavigable, isolated waters may not be regulated by the Corps. The entire project area has tentatively been identified as being jurisdictional wetlands, however, a final decision has not been made. As part of the wetland delineation and verification process, the Corps will determine whether the wetlands are isolated and therefore not regulated under Section 404 of the CWA.

If the wetlands are jurisdictional and could be filled as part of the project, the Corps may issue either an individual permit or general permits on a program level (more likely an individual permit if federally listed species are associated with the wetlands and given the size of the project). General permits are

authorized and issued to cover similar activities that are expected to cause only minimal individual and cumulative adverse environmental effects.

Nationwide permits are general permits that cover activities such as minor dredging, construction of temporary structures (e.g., cofferdams) and fill activities. Nationwide permits have a set of general conditions that must be met for the permits to apply to a project, as well as specific conditions that apply to each nationwide permit.

The following conditions would need to be met as part of the Section 404 permitting process:

- procurement of Section 401 water quality certification from the San Francisco Bay RWQCB;
- compliance with ESA, involving consultation with USFWS, if the project is likely to jeopardize the continued existence of a threatened or endangered species or its critical habitat; and
- compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA).

DFG will obtain a Corps permit for the portions of the project implemented by the state. A Corps project does not need a Section 404 permit; instead, the Corps conducts an equivalent evaluation in-house. This Section 404(b)(1) evaluation is described in Appendix B.

Executive Order 11990—Protection of Wetlands

Executive Order 11990 (issued in 1977) is an overall wetland policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state and local projects. It requires federal agencies to follow procedures for avoidance, mitigation, and preservation, with public input, before proposing new construction in wetlands. When federal lands are proposed for lease or sale to nonfederal parties, Executive Order 11990 requires that the lease or conveyance contain restrictions to protect and enhance the wetlands on the property. In this capacity, Executive Order 11990 can affect the sale of federal lands with wetlands.

Compliance with Section 404 permit requirements may constitute compliance with the requirements of Executive Order 11990. Evidence of compliance would be provided in the CEQA or NEPA document prepared for the proposed project or action.

For this project, the Corps would determine whether the proposed project is consistent with Executive Order 11990. The project appears consistent, as there is no federal land involved.

5.1.2.2 State

California Environmental Quality Act

CEQA is the regulatory framework by which California public agencies identify and mitigate significant environmental impacts. A project normally would have a significant environmental impact on biological resources if it would substantially

- affect a rare or endangered species or the habitat of that species;
- interfere with the movement of resident or migratory fish or wildlife; or
- diminish habitat for fish, wildlife, or plants.

The State CEQA Guidelines define *rare, threatened, or endangered species* as those listed under CESA and ESA as well as any other species that meet the criteria of the resource agencies or local agencies—for example, the DFG-designated "species of special concern" and CNPS–listed species. The State CEQA Guidelines state that the lead agency preparing an EIR must consult with and receive written findings from DFG concerning project impacts on species that are listed as endangered or threatened. If DFG is the lead agency, then this is done as part of certifying the Final EIR. The effects of a proposed project on these resources are important in determining whether the project has significant environmental impacts under CEQA.

California Endangered Species Act

California implemented CESA in 1984. The act prohibits the take of endangered and threatened species; however, habitat destruction is not included in the state's definition of take. Section 2090 of CESA requires state agencies to comply with endangered species protection and recovery and to promote conservation of these species. DFG administers the act and authorizes take through Section 2081 agreements (except for species designated as fully protected). Regarding rare plant species, CESA defers to the California Native Plant Protection Act of 1977, which prohibits importing rare and endangered plants into California, taking rare and endangered plants, and selling rare and endangered plants. State-listed plants are protected mainly in cases in which state agencies are involved in projects under CEQA. In these cases, plants listed as rare under the California Native Plant Protection Act are not protected under CESA but can be protected under CEQA. If DFG is the lead agency, then CESA compliance is done as part of certifying the Final EIR.

California State Wetlands Conservation Policy

The Governor of California issued an executive order on August 23, 1993, that created a California State Wetlands Conservation Policy. This policy is being implemented by an interagency task force that is jointly headed by the State

Resources Agency and the California Environmental Protection Agency (Cal/EPA). The policy has three goals:

- to ensure no overall net loss and a long-term net gain in wetlands acreage and values in a manner that fosters creativity, stewardship, and respect for private property;
- to reduce the procedural complexity of state and federal wetlands conservation program administration; and
- to encourage partnerships that make restoration, landowner incentives, and cooperative planning the primary focus of wetlands conservation.

Regional Water Quality Control Boards

Water Code Section 13260 requires "any person discharging waste, or proposing to discharge waste, in any region that could affect the waters of the state to file a report of discharge (an application for waste discharge requirements)." *Waters of the state* is defined in the Porter-Cologne Water Quality Control Act as "any surface water or groundwater, including saline waters, within the boundaries of the state" (Water Code Section 13050[e]). The SWANCC ruling described above has no bearing on the Porter-Cologne definition. Although all waters of the United States that are within the borders of California are also waters of the state, the converse is not true (i.e., in California, waters of the United States represent a subset of waters of the state). Thus, California retains authority to regulate discharges of waste into any waters of the state, regardless of whether the Corps has concurrent jurisdiction under Section 404.

If the Corps determines that the wetland is not subject to regulation under Section 404 of the CWA, Section 401 water quality certification is not required. However, the appropriate RWQCB may impose WDRs if fill material is placed into waters of the state.

Section 1600 *et seq.* of the California Fish and Game Code

DFG has jurisdictional authority over wetland resources associated with rivers, streams, and lakes under California Fish and Game Code, Sections 1600–1607. DFG has the authority to regulate all work under the jurisdiction of the State of California that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. Activities of agencies that are project proponents are regulated under Section 1601. Activities of private individuals who are project proponents are regulated under Section 1603.

In practice, DFG marks its jurisdictional limit at the top of the stream or lake bank or the outer edge of the riparian vegetation, where present, and sometimes extends its jurisdiction to the edge of the 100-year floodplain. Because riparian habitats do not always support wetland hydrology or hydric soils, wetland

boundaries as defined by Section 404 sometimes include only portions of the riparian habitat adjacent to a river, stream, or lake. Therefore, jurisdictional boundaries under Section 1600 *et seq.* may encompass a greater area than that regulated under Section 404.

DFG enters into a lake or streambed alteration agreement with a project proponent and can impose conditions on the agreement to ensure that no net loss of wetland values or acreage will be incurred. The lake or streambed alteration agreement is not a permit but, rather, a mutual agreement between DFG and the project proponent.

~~The project sponsors would prepare a streambed alteration agreement for the proposed project.~~ DFG has determined that the restoration project area is not subject to Section 1600.

5.1.2.3 Special-Status Plant Species and Sensitive Communities

Special-status plant species are protected under CESA and ESA or other regulations and are considered sufficiently rare by the scientific community to qualify for such listing. For purposes of this report, *special-status plants* refers to species that

- are listed or proposed for listing as threatened or endangered under ESA (50 CFR 17.12) and various notices in the *Federal Register* (proposed species);
- are candidates for possible future listing as threatened or endangered under ESA (64 FR 57534, October 25, 1999);
- are listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5);
- meet the definition of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- are listed as rare under the CNPPA (California Fish and Game Code, Section 1900 *et seq.*);
- are considered by CNPS to be "extinct, rare, threatened, or endangered in California" (Lists 1A, 1B, and 2, July 6, 2000, available at www.cnps.org/rareplants/inventory/6thEdition.htm [California Native Plant Society 2001]); and
- are listed by CNPS as plants about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4, July 6, 2000, available at www.cnps.org/rareplants/inventory/6thEdition.htm [California Native Plant Society 2001]), which may be included as special-status species on the basis of local significance or recent biological information.

ESA does not give plants legal protection on nonfederal lands unless a state law or regulation is being violated. ESA does prohibit malicious damage or destruction of threatened or endangered plant in any area under federal jurisdiction, and the removal, cutting, digging up, or damaging or destroying of any such species in any other area in knowing violation of any state law or regulation, or in the course of any violation of a state criminal trespass law.

Species of concern are sensitive species that have not been listed, proposed for listing, or placed in candidate status. *Species of concern* is an informal term used by some but not all USFWS offices. Species of concern receive no legal protection, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species. Potential project-related effects on species of concern, however, are disclosed as part of this document.

California Native Plant Society Listings

CNPS tracks plant species considered rare in California and assigns them to one of five lists in an effort to categorize their degree of rarity. Project-related effects on plant species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380) should be disclosed in EIRs and EISs. DFG recognizes that plants on CNPS Lists 1A, 1B, and 2 would qualify for listing under Sections 2062 and 2067 of CESA and recommends they be addressed in EIRs. Some of the plants on CNPS Lists 3 and 4 may also qualify for listing under Sections 2062 and 2067 of CESA, and project-related effects should be described in EIRs and EISs. However, a plant need not be listed by CNPS to be considered under CEQA if it is a *de facto* rare, threatened, or endangered species. In addition, DFG recommends, and local governments may require, protection and disclosure of impacts on plants that are regionally significant, such as locally rare species or disjunct populations of more common plants.

Sensitive Communities

Sensitive communities are considered those described as Significant Natural Areas (SNAs) by DFG, communities that are either known or believed to be of high priority for inventory in the CNDDB because of their rarity or level of threat (California Department of Fish and Game 2001), or protected or regulated by federal, state, or local laws and regulations. In the project area, sensitive communities include tidal marshes described below.

5.1.3 Regional Setting

More than ~~79~~85–90% of tidal wetlands in the Bay Area have been lost to reclamation by diking, filling, and draining vast sections of marsh for agriculture, urbanization, and salt production (Goals Project 2000). However, there are

approximately 200,000 acres of shallow-water subtidal habitats remaining;~~, and~~ approximately 171,000 acres of these are subtidal habitat and approximately 29,000 acres are tidal flats.

The subtidal and tidal habitat that borders San Pablo Bay receives substantially greater freshwater input than marshes bordering San Francisco Bay to the south. Consequently, the habitats tend to be more brackish and support a more diverse plant assemblage than salt marshes elsewhere in the San Francisco Bay area.

The regional vegetation setting of the Water Delivery Option for salt pond restoration spans the entire north bay area adjacent to the San Pablo Bay. Sixty percent of this area is extensive (pastureland) and intensive (cultivated) agriculture, 23% is wildlife areas and open space, and 10% is urban lands (7% is undesignated) (San Francisco Bay Conservation and Development Commission 1997).

5.1.4 Project Setting

Vegetation communities at the Napa River Unit, the project area for the salinity reduction and habitat restoration options, are determined primarily by elevation, which in turn controls tidal influence, salinity, and water level. The area includes 7,190 acres of abandoned salt ponds and levees and 2,270 acres of fringing marsh, restored marsh, and sloughs for a total project area of 9,460 acres. Vegetation communities in the project area are described below and include tidal marsh, restored salt pond, abandoned salt pond, and levees. Note that project-specific botanical surveys have not been conducted, and following descriptions are based on habitat descriptions for other projects in the project area or on descriptions of similar habitats in the vicinity.

The study area for the Project Component of the Water Delivery Option, including the currently proposed Sonoma Pipeline, Napa Pipeline, and CAC Pipeline, follows the alignment of each pipeline. A preliminary field survey of this portion of the pipeline route was conducted in February, March, and December 2002.

The new segments of the Sonoma Pipeline begin just south of the juncture of East Eighth Street and SR 12/121 near Schellville. The pipeline crosses ruderal and grazed bayland and Schell Creek as it heads east toward the NWPRA railroad tracks. As it joins the railroad tracks, the alignment turns southeast and continues toward the Hudeman Slough Mitigation and Enhancement Wetlands (HSMEW) area. While paralleling the railroad tracks, the Sonoma Pipeline passes vineyards, farmed bayland, seasonal wetlands, and the Ringstrom Bay Unit of DFG's NSMWA. The HSMEW area contains permanent and seasonal wetlands, grasslands, and storage ponds. The pipeline continues to parallel the south side of the railroad tracks through this area.

At Skaggs Island Road, the Sonoma Pipeline route crosses underneath the railroad tracks and proceeds along the north side of the railroad to Buchli Station

Road (the access road for the Napa River Unit). The north side of the tracks is primarily vineyard uplands, with potential seasonal wetlands in swales adjacent to the tracks. As the Sonoma Pipeline route approaches Huichica Creek, it crosses a small portion of the Huichica Creek Unit of the NSMWA. This unit is mostly leveed marsh.

The Sonoma Pipeline route continues on the north side of the railroad tracks, again through vineyard uplands and seasonal wetland swales, until it turns south at the terminus of Buchli Station Road, where it proceeds along an access road to the new mixing chamber located between Ponds 7 and 7A. Habitat types along the Sonoma Pipeline alignment are illustrated in Figure 5-1.

The currently proposed Napa Pipeline would be constructed in two segments. The first segment would begin on the east side of the Napa River by connecting to an existing reclaimed water pipeline, then head west. The pipeline would tunnel under the Napa River onto the Stanly property and then travel under roads to the intersection of Las Amigas and Buchli Station Roads (Figure 2-10). Segment 1 has been evaluated in a previous environmental document (Los Carneros Recycled Water Irrigation Pipeline Initial Study/Mitigated Negative Declaration). Segment 2 would proceed south along Buchli Station Road until it intersects with the Sonoma Pipeline at the railroad tracks paralleling the northern boundary of the Huichica Creek Unit of the NSMWA. Habitat types on either side of Buchli Station Road include vineyard and ruderal. Figure 5-2 illustrates habitat types along the Napa Pipeline route.

The CAC Pipeline would begin at the southern terminus of Mezzetta Court at the CAC WWTP. Mezzetta Court is lined by industrial businesses. It would head north for approximately 2,000 feet until it intersects with Green Island Road. The pipeline then would travel north and westward along Green Island Road. On Green Island Road, the pipeline would pass through industrial areas, upland/grassland, and vineyards. It then would traverse the former Cargill Salt property and connect with the existing ~~Cargill Salt~~ pipeline that crosses beneath the Napa River to connect with the salt ponds within the Napa River Unit. Figure 5-2 illustrates habitat types along the Napa Pipeline route.

5.1.4.1 Vegetation Communities

Open Water~~—Streams and Creeks~~

~~The pipelines proposed under the Water Delivery Option would cross a number of major creeks (Gallinas, Miller, Novato, Tolay, and Sonoma), minor creeks (Pacheco, Arroyo San Jose, Wheat, Stage Gulch, and Huichica), sloughs (Steamboat and Schell), and rivers (Napa and Petaluma).~~ The dominant vegetation of open-water habitat are phytoplankton, including diatoms, dinoflagellates, green algae, and blue-green algae.

Mudflat

As the tide inundates broad shallow areas, it deposits sediments that are then exposed as the tide recedes, leaving mudflats. Vegetation in these mudflats consists of a variety of algae, algal detritus, and seeds for lower tidal marsh species.

Tidal Marsh

Levees and water control structures prevent tidal influence in most ponds and minimize it in the remaining ponds (except Pond 2A). Tidal marsh habitat was retained during the reclamation era along slough margins in the project area. Diking, however, reduced the tidal prism in the sloughs and reduced flows, resulting in increased siltation and narrowing of the channel cross section.

Tidal marsh habitat in the project area outside of Pond 2A is restricted to "~~outboard levee~~fringe marsh" habitat (i.e., between the levees and slough channels), largely on accreted sediments. Tidal marsh vegetation communities are represented in tidal sloughs. Tidal sloughs in the project area include Dutchman Slough, South Slough, China Slough, Devil's Slough, Napa Slough, Mud Slough, and Hudeman Slough as illustrated on Figure 2-2. Tidal marsh communities are well established between the open sloughs and levees in the project area. In portions of the project area, the outboard levee habitat area is broad (more than 100 feet wide) and supports substantial areas of tidal marsh habitat.

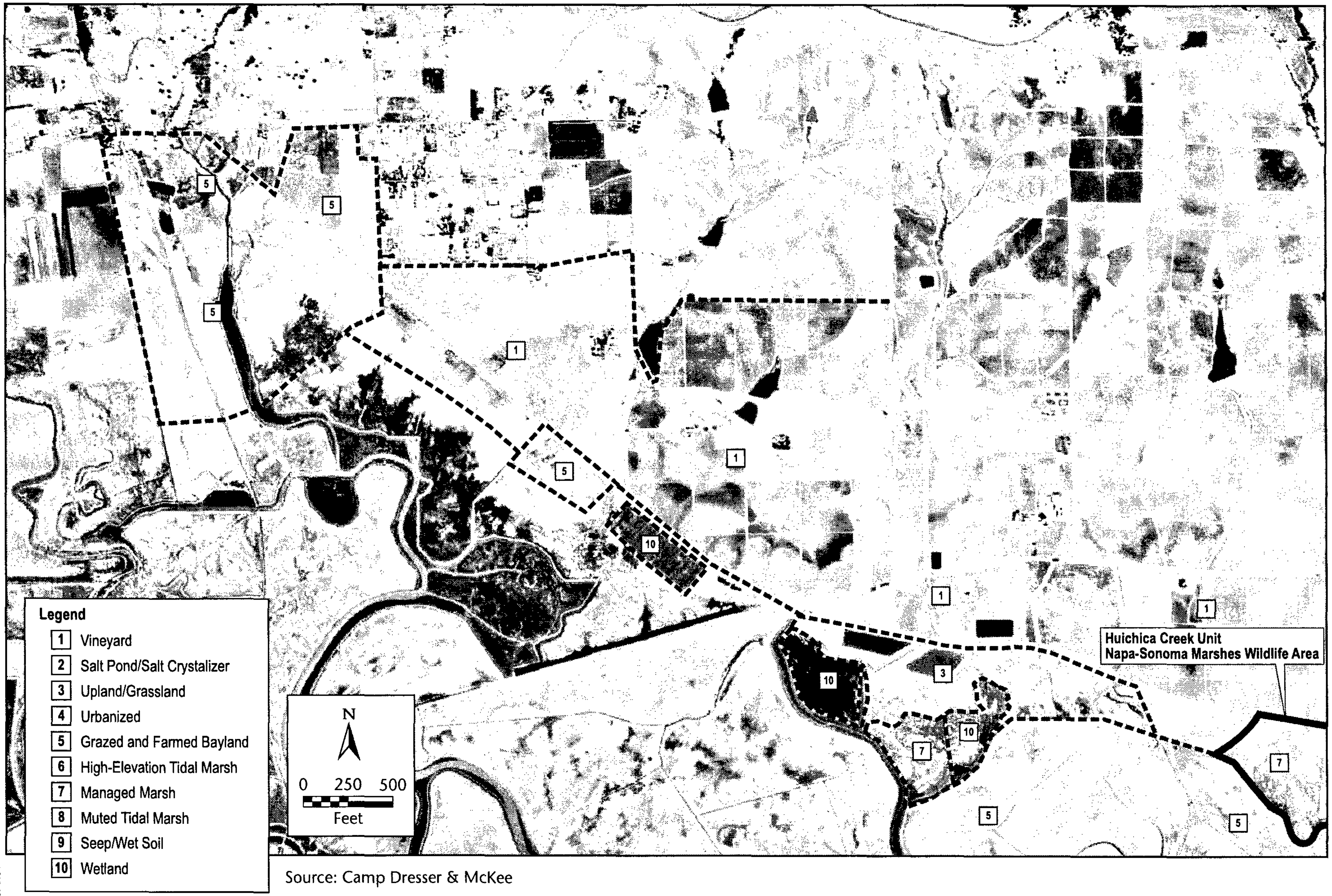
Exceptionally high productivity and biomass, but low species diversity, characterize tidal marsh communities. Relatively few plant species can tolerate the natural variations in water levels and salinity. Vegetation is generally low growing and herbaceous, either forming a low dense mat or dominated by clumps of emergent species. Tidal marshes in the project area are relatively brackish because of the influx of fresh water from the Napa River and thus support a broader range of species than true salt marshes typical of San Francisco Bay. In general, salinity decreases away from San Pablo Bay. Salinity, however, varies greatly seasonally and annually with variations in precipitation and stream discharge. Salinity increases during the summer and during drier years.

~~Tidal marsh vegetation communities are also represented in tidal sloughs. Tidal sloughs in the project area include Dutchman Slough, South Slough, China Slough, Devil's Slough, Napa Slough, Mud Slough, and Hudeman Slough as illustrated on Figure 2-2.~~

Tidal brackish marsh communities are segregated into three distinct elevation zones described below: lower, middle, and upper tidal marsh (Figure 5-3).

Lower Tidal Marsh

Lower tidal marsh (lower marsh) occurs above mudflats along stream and slough channels and typically is found between MTL and mean high water (MHW)

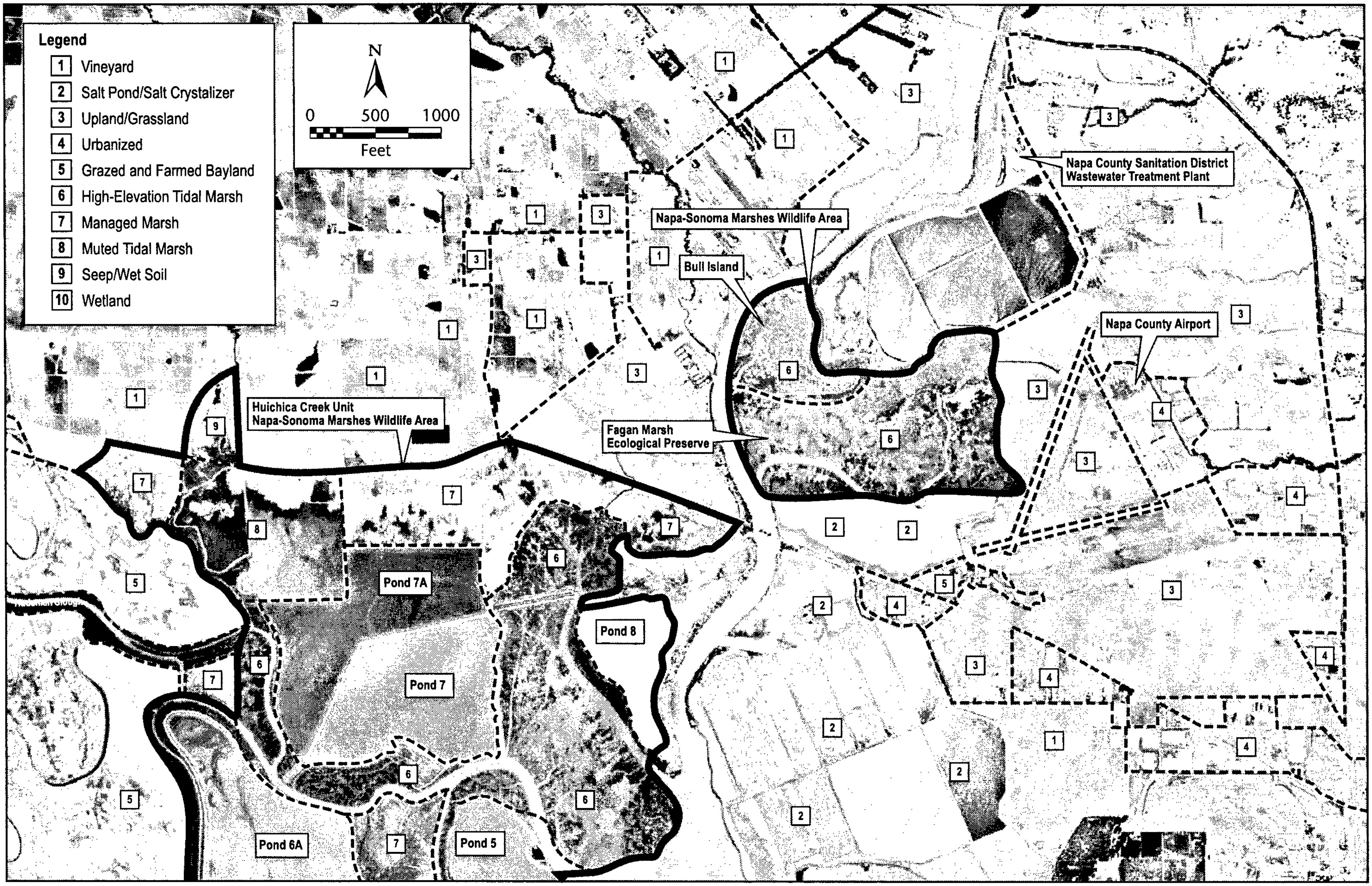


Source: Camp Dresser & McKee

01396.01

Jones & Stokes

Figure 5-1
Habitat Types Adjacent to the Sonoma Pipeline

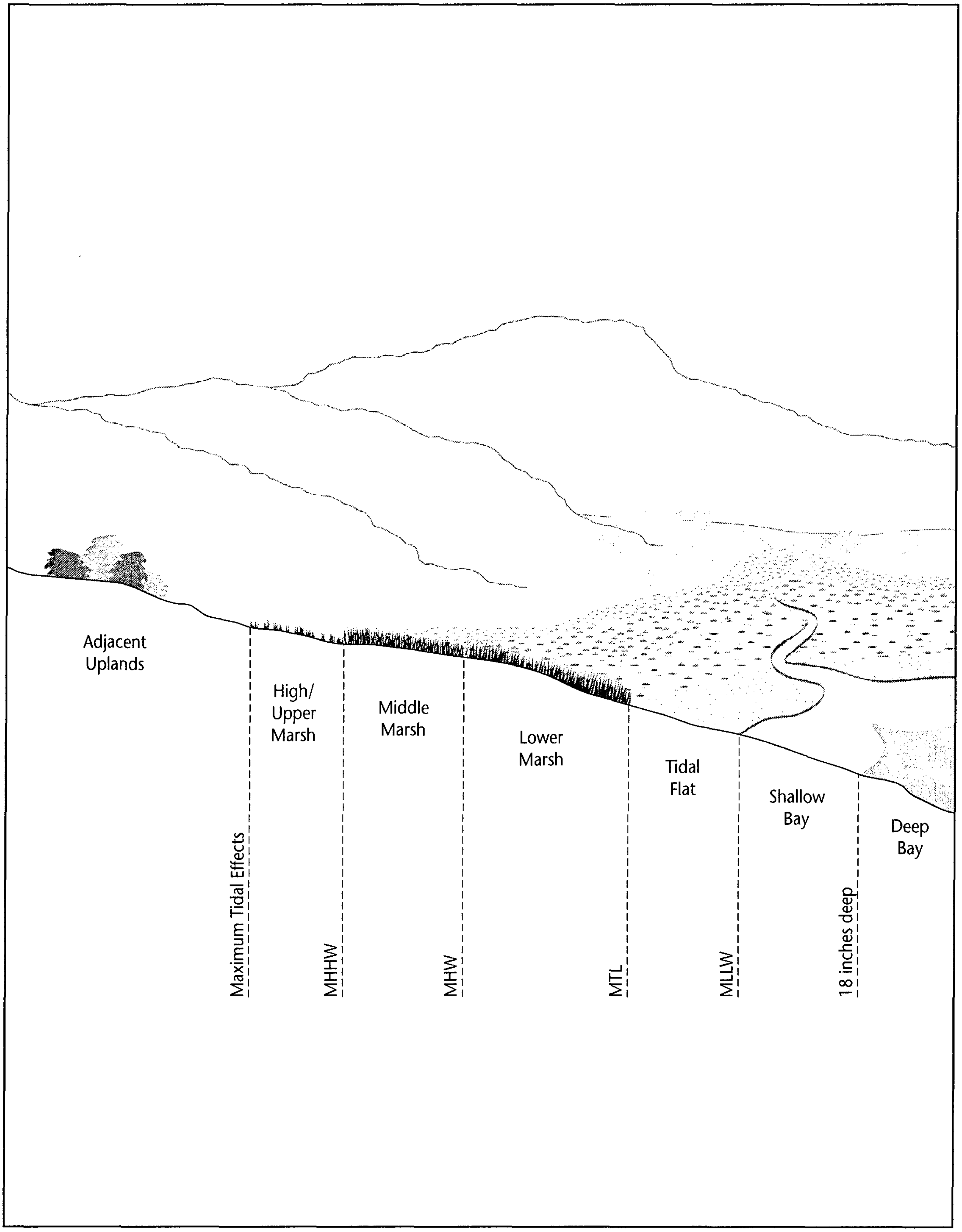


Source: Camp Dresser & McKee

01396.01

Jones & Stokes

Figure 5-2
Habitat Types Adjacent to the Sonoma and Napa Pipelines



Jones & Stokes

Figure 5-3
Marsh Tidal Elevations

(3.3–5.5 feet National Annual Vertical Datum [NAVD] 88). This habitat is within the range of daily tidal fluctuations, with the ground surface and low-growing plants being exposed at low tides and completely inundated at higher tides and during periods of high stream discharge.

This community typically is dominated by species of cord grass, an emergent wetland species, including California cord grass (*Spartina foliosa*). Other common species in this community include pickleweed (*Salicornia virginica*), annual pickleweed (*S. europea*), alkali bulrush (*Scirpus robustus, S. maritimus*), fleshy jaumea (*Jaumea carnosa*), curly dock (*Rumex crispus*), and brass buttons (*Cotula coronopifolia*). California tule (*Scirpus californicus*), hard stem tule (*S. acutus*), three-square bulrush (*S. americanus*), and cattails (*Typha angustifolia, T. latifolia,* and *T. dominguensis*) occur in lower-salinity areas.

Lower marshes in the region are currently threatened by invasion of smooth cord grass (*Spartina alternifolia*), which outcompetes and hybridizes with the native California cord grass. Coon Island, however, immediately adjacent to ponds in the project area, supports the best extant stand of California cord grass in the Bay Area, and smooth cord grass has not been identified during directed searches in the Napa River Unit with the exception of a small patch in Pond 2A a couple of years ago.

Middle Tidal Marsh

Middle tidal marsh (middle marsh) occurs between MHW and MHHW (5.5–6.0 feet NAVD 88). This habitat is inundated only during higher high tides. Pickleweed is typically the dominant species, forming a dense, low growing mat. Other typical species include Baltic rush (*Juncus balticus*), saltmarsh dodder (*Cuscuta salina*), frankenia (*Frankenia salina*), fat hen (*Atriplex triangularis*), brass buttons, bulrush, tules, cattails, arrow grass (*Triglochin maritima*), club rush (*Scirpus cernuus*), and fleshy jaumea. In more brackish areas located away from San Pablo Bay, tules and cattails are dominant.

Upper Tidal Marsh

Upper tidal marsh (upper marsh) occurs from MHHW and up several feet (>6.0 feet NAVD 88) to the maximum elevation of tidal effects. This habitat is inundated only during higher high tides. Salt grass (*Distichlis spicata*) and pickleweed are typical dominant species in relatively saline areas, and gum plant (*Grindelia stricta* var. *angustifolia*) ~~can also be~~ is locally dominant. Other typical species include sea lavender (*Limonium californicum*), sneezeweed (*Helenium bigelovii*), yarrow (*Achillea borealis*), ~~mugwort (*Artemisia douglasiana*),~~ frankenia, Baltic rush, fat hen, arrow grass, ~~goldenrod (*Solidago occidentalis*), aster (*Aster chilensis*),~~ and sedges (*Carex* spp.). Nonnative pepperweed (*Lepidium latifolium*), poison hemlock (*Conium maculatum*), and fennel (*Foeniculum vulgare*) can invade higher elevations of this community, especially along the bases of levees. Iceplant (*Carpobrotus edulis*) is one of the most abundant high marsh species found on the levees, as are native marsh baccharis (*Baccharis douglassii*) and coyote brush (*B. pilularis*). Pepperweed can form extensive, monotypic stands and outcompete native vegetation species.

Disturbed Marsh/Leveed Baylands

The marsh areas of the north bay region have often been leveed to create additional land, primarily for agriculture. These areas are considered disturbed marsh and continue to exist as several subhabitats.

Some disturbed marsh areas have been reclaimed and reopened as tidal marsh. Vegetation in these areas is similar to that of natural tidal marsh except that many of the vegetation stands are monodominant because of the lack of a natural variation in topography as a result of years of plowing and agriculture.

Disturbed marsh can also be leveed and seasonal. In this habitat, the land is dry for portions of the year and wet during the rainy season. As the rains taper off and the ponded waters begin to evaporate, the concentration of salts at the surface increases. Native vegetation such as saltgrass, frankenia, pickleweed, Baltic rush, and fat hen are found within this habitat. However, the predominant vegetation is often invasive grasses and herbs.

There are also leveed marsh areas that have a permanent water source through a mixture of rainwater and seepage. These leveed permanent marshes are dominated by saltgrass meadows. If sufficient water exists, cattails, tules, and alkali bulrush can be found.

Seasonal Wetland

Seasonal wetlands function as wetlands during the rainy season and uplands during the dry season. They typically form in shallow depressions throughout the area. Seasonal wetlands frequently develop along road and railroad corridors where adjacent swales and drainage ditches are created to aid in controlling stormwater runoff. Natural seasonal wetlands can also be found within the San Pablo baylands. Three predominant vegetation compositions exist within a seasonal wetland:

- pickleweed and brass buttons in saline seasonal wetlands,
- pickleweed and alkali bulrush in brackish seasonal wetlands, and
- rushes and sedges in freshwater seasonal wetlands.

The pipelines proposed under the Water Delivery Option would cross a number of major creeks (Gallinas, Miller, Novato, Tolay, and Sonoma), minor creeks (Pacheco, Arroyo San Jose, Wheat, Stage Gulch, and Huichica), sloughs (Steamboat and Schell), and rivers (Napa and Petaluma) that may have seasonal wetlands.

Restored Salt Ponds

Tidal influence was restored to Pond 2A, a 525-acre abandoned salt pond in the Napa River Unit (Figure 2-2), through designed levee breaches in 1995 and 1997.

Within 1 year of the breach, total vegetation cover went from less than 10% to 25–30%. Within 5 years, vegetation cover approached 90%. The dominant species include prairie bulrush (*Scirpus maritima*), California cord grass, pickleweed, and cattail. The restoration of vegetation in Pond 2A has been similar to other salt pond restoration projects in the region, where cattails, common tule, California bulrush, and alkali bulrush have quickly become established as salinity decreases. Salt grass, tules, frankenia, cattails, and fat hen are also typical early colonizers of restored ponds.

Abandoned Salt Ponds

The salt ponds in the Napa River Unit support few plant species because of the high levels of salinity in the soils. Wigeon grass (*Ruppia maritima*), salt grass, and pickleweed occur in some areas, but these habitats are mostly devoid of vegetation.

Levees

The lower portions of the levees support upper marsh species such as gum plant, salt grass, sedges, tules, and cattails. Higher elevations, above tidal influence, typically support riparian and upland species such as coyote brush (*Baccharis pilularis*), toyon (*Heteromeles arbutifolia*), poison-oak (*Toxicodendron diversilobium*), California rose (*Rosa californica*), blue elderberry (*Sambucus coerula*), and Himalaya blackberry (*Rubus discolor*). Windrows of planted trees, such as eucalyptus (*Eucalyptus* spp.), occur along some levees and levees on Ponds 4 and 5. Iceplant is one of the most abundant high marsh species found on the levees, as are native marsh baccharis and coyote brush. The nonnative pepperweed, poison hemlock, and yellow star-thistle (*Centaurea solstitialis*) have also invaded some levees in the project area.

Upland

Grassland

Grassland vegetation is dominated by annual and perennial grasses and forbs. This vegetation includes both natives and nonnative species such as wild oats, soft chess (*Bromus hordeaceus*), filaree, California oatgrass (*Danthonia californica*), red fescue (*Festuca rubra* var. *rubra*), California needlegrass, ryegrass, and clover.

Agricultural

Most of the upland habitat within the north bay region has been converted to agriculture, including oat hay, pastureland, and more recently, vineyards. These areas support a mixture of native and nonnative vegetation in the form of annual grasses, herbs, and wildflowers, along with oat hay and grapevines.

Ruderal

Ruderal vegetation appears where repeated disturbance, such as vehicular traffic, alters the natural ecosystem. Ruderal species are typically aggressively growing, nonnative plants such as black mustard (*Brassica nigra*), field mustard (*Brassica campestris*), yellow star-thistle, poison hemlock, sweet fennel (*Foeniculum vulgare*), and prickly lettuce.

Urban

Urban vegetation is dominated by landscaped grasses, flowers, shrubs, and trees, both native and nonnative.

5.1.4.2 Special-Status Plant Species

Several special-status plant species associated with tidal marsh habitats have been reported to occur in the Napa River Unit portion of the project area and vicinity, or have high potential to occur in suitable habitat types in the project area:

- Suisun Marsh aster (*Aster lentus*),
- San Joaquin spearscale (*Atriplex joaquiniana*),
- soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*),
- Delta tule pea (*Lathryus jepsonii* var. *jepsonii*),
- Mason's liliaeopsis (*Liliaeopsis masonii*),
- Marin knotweed (*Polygonum marinense*), and
- California cord grass (*Spartina foliosa*).

Table 5-2 summarizes these species, their listing status, geographic distribution, habitat requirements, and potential to be affected by the project. Soft bird's-beak is described below.

Several special-status plant species also have potential to occur outside of tidal marsh habitat in the vicinity of the Napa and Sonoma Pipelines of the Water Delivery Option. These species are listed in Table 5-3.

Soft Bird's-Beak

Soft bird's-beak is a federally listed endangered and state listed rare hemiparasitic annual herb. It is occurs in upper tidal marsh habitat near the upper margins of tidal influence. Typical associates include pickleweed, salt grass, fleshy jaumea, alkali heath, perennial ryegrass, arrow grass, and Suisun Marsh aster. Restricted to about nine populations and distributed over about 31 acres of occupied habitat, soft bird's-beak is reported from the margins of the Napa River Unit, the Petaluma River, Honker Bay, San Pablo Bay, and Suisun Marsh. Population sizes of soft bird's-beak fluctuate from year to year, and it is expected

Table 5-2. Special-Status Plant Species with Potential to Occur in the Project Area and Vicinity

Common and *Scientific Name*	Legal Status[1] Federal/State/ CNPS	Geographic Distribution and Population Status	Habitat Requirements and Blooming Period	Potential to be Affected by Project
Suisun Marsh aster *Aster lentus*	SC/–/1B	Delta, Suisun Marsh, Suisun Bay. Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties. Seriously threatened by marsh habitat alteration and loss. Intergrades into *A. chilensis*.	Brackish and freshwater marsh, silty areas, 0–3 meters [m]. Occurs with pickleweed, arrow grass, salt bush, bulrush, soft bird's beak, and Delta tule pea. Blooms May–November.	A population is reported 2 miles northeast of Pond 8 at Fagan Marsh Ecological Reserve on the Napa River. Other populations may occur along sloughs and the Napa River in the project area, and may be affected by ground disturbance or changes in hydrology and sedimentation.
San Joaquin spearscale *Atriplex joaquiniana*	SC/–/1B	Alameda, Contra Costa, Colusa, Glenn, Merced, Monterey, Napa, Sacramento, San Benito, Santa Clara*, San Joaquin*, Solano, Tulare*, and Yolo Counties. Threatened by grazing, agriculture, and development.	Alkali grassland, alkali scrub, alkali meadows, saltbush scrub, 1–320 m. Occurs with salt grass and alkali heath above pickleweed habitat. Blooms April–October.	A population is reported 1 mile east of Pond 4 across the Napa River. This species may occur in suitable habitat in the project area and be affected by ground disturbance and changes in hydrology or sedimentation.
Soft bird's-beak *Cordylanthus mollis* ssp. *mollis*	E/R/1B	San Francisco Bay region, Suisun Marsh, Contra Costa, Marin*, Napa, Sacramento*, Solano, Sonoma.* Limited to nine extant populations covering a total of <31 acres, with three sites <1 acre. Threatened by erosion, marsh drainage, urbanization, collecting, invasion by pepperweed (*Lepidium latifolium*) and pollution.	Tidal salt marsh, 0–3 m. An annual, hemiparasitic herb that with fluctuating population levels. Occurs in upper tidal marsh near the limits of tidal action with pickleweed, salt grass, fleshy jaumea, alkali heath, perennial ryegrass, arrow grass, and Suisun marsh aster. Blooms July–November.	A population on degraded, marginal habitat on the south levee at the confluence of Dutchman and South Sloughs near Pond 3 had 50 individuals in 1982, but was not seen in 3 subsequent searches. This population may be extirpated. A population at Bentley Wharf 0.25 mile west of Pond 7A is considered extirpated. A 3-acre population occurs on Fagan Slough on the Napa River 2 miles northeast of Pond 8, but project activities would not affect this site. Regular surveys by DWR at the Napa River Unit have not identified new populations. A low probability exists that unknown populations occur in the project area.

Table 5-2. Continued

Common and *Scientific Name*	Legal Status[1] Federal/State/ CNPS	Geographic Distribution and Population Status	Habitat Requirements and Blooming Period	Potential to be Affected by Project
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	SC/–/1B	Delta to San Francisco Bay region, Alameda, Contra Costa, Napa, Sacramento, Santa Clara*, San Joaquin, and Solano Counties. Most populations small. Threatened by agriculture, water diversions, and erosion.	Coastal and estuarine marshes, 0–4 m. Occurs with salt grass, pickleweed, arrow grass, bulrush, fleshy jaumea, Suisun marsh aster, and soft bird's-beak. Blooms May–September.	Several populations are reported from the immediate vicinity of the project area, including a 45.7-acre population at South Slough, and along the Napa River at Coon Island and Pond 8. Populations likely occur along sloughs and the Napa River in the project area, and may be affected by ground disturbance or changes in hydrology and sedimentation. Populations sometimes are ephemeral, so additional populations may turn up at the time of construction.
Mason's lilaeopsis *Lilaeopsis masonii*	SC/R/1B	Southern Sacramento Valley, Delta, northeast San Francisco Bay area, Alameda, Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties. Locally common in Suisun Bay. Threatened by erosion, channel stabilization, development, flood control projects, recreation, agriculture, shading resulting from marsh succession, and competition with nonnative *Eichhornia crassipes*. Many populations ephemeral, exploiting newly deposited or exposed sediments.	Freshwater and brackish intertidal marshes, streambanks in riparian scrub, silty areas generally at mean sea level. Occurs with arrow grass, fleshy jaumea, brass buttons and pickleweed. Blooms April–November.	Populations are reported from the banks of the Napa River above and below the project site. The closest reported population is 0.25 mile across the Napa River from Pond 3. Populations are expected to occur along sloughs and the Napa River in the project area, and may be affected by ground disturbance or changes in hydrology and sedimentation.

Table 5-2. Continued

Common and *Scientific Name*	Legal Status[1] Federal/State/ CNPS	Geographic Distribution and Population Status	Habitat Requirements and Blooming Period	Potential to be Affected by Project
Marin knotweed *Polygonum marinense*	SC/–/3	Coastal Marin, Napa, Solano, and Sonoma Counties. Known from fewer than 15 occurrences. Taxonomic status uncertain, related to *P. aviculare*; possibly synonym of *P. robertii*, a nonnative plant.	Coastal salt marsh and higher elevation coastal brackish marsh, 0–10 m. Occurs with pickleweed, salt grass, and gum plant. Blooms April–October.	3 populations are reported from the project vicinity, including Fagan Marsh about 2 miles northeast of Pond 8, and about 1 mile east of Pond 3 across the Napa River. Populations may occur in suitable habitats in project area, and ground disturbance or changes in hydrology and sedimentation may affect this species.
California cord grass *Spartina foliosa*	SC/–/–	Coastal California, including Bay Area, Del Norte, Santa Barbara, Los Angeles, Orange, and San Diego Counties. Extirpated from South San Francisco Bay. Threatened by habitat conversion and hybridization with nonnative smooth cord grass (*Spartina alternifolia*).	Coastal salt marsh and brackish marsh, 0–10 m (mostly 0.2–0.4 m MTL). Occurs with smooth cord grass, arrow grass, pickleweed, and alkali heath. Blooms May–July.	Coon Island immediately adjacent to several ponds in the project area supports the greatest extant population of California cord grass in the Bay Area. In other restoration projects, this species has rapidly colonized habitats >0.2 m MTL within 0–3 years. Nonnative competing cord grasses, which have adversely affected populations in most of the Bay Area, was recently reported from the project area. This species is expected to occur in the project area and vicinity in lower tidal marsh habitats.

Table 5-2. Continued

Common and *Scientific Name*	Legal Status[1] Federal/State/ CNPS	Geographic Distribution and Population Status	Habitat Requirements and Blooming Period	Potential to be Affected by Project

[1] Status explanations:

Federal
- E = listed as endangered under the federal Endangered Species Act.
- SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.
- -- = no listing.

State
- R = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
- -- = no listing.

California Native Plant Society
- 1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
- 3 = List 3 species: plants about which more information is needed to determine their status.
- * = Known populations believed extirpated from that County

to be highly sensitive to changes in growing conditions and may not readily colonize new habitat in restored salt ponds.

There is one reported population of soft bird's-beak that may occur outside the south levee at the confluence of Dutchman's and South Slough, just west of Pond 3. This population has not been observed since 1982, and focused searches in 1983, 1986, and 1993 failed to reidentify this population or additional populations in the project area. Extant populations in the vicinity are located at Fagan Slough 2 miles northeast of Pond 8, Vallejo, Pinole Point, and Benicia State Park. A population at Bentley's Wharf just west of Pond 7A is considered extirpated. Soft bird's-beak is considered to have low potential to occur in the project area and vicinity in suitable upper marsh habitat.

Table 5-3. Special-Status Plant Species That May Occur in the Vicinity of the Water Delivery Pipelines

Common and Scientific Name	Legal Status[1] Federal/State/ CNPS	Common and Scientific Name	Legal Status[1] Federal/State/ CNPS
Franciscan onion *Allium peninsulare* var. *franciscanum*	--/--/1B	Contra Costa goldfields *Lasthenia conjugens*	E/--/1B
Mt. Tamalpais manzanita *Arctostaphylos hookeri* ssp. *montana*	--/--/1B	Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	SC/--1B
Suisun Marsh aster *Aster lentus*	SC/--/1B	Legenere *Legenere limosa*	SC/--/1B
Alkali milk-vetch *Astragalus tener* var. *tener*	SC/--/1B	Woolly-headed lessingia *Lessingia hololeuca*	--/--/3
San Joaquin spearscale *Atriplex joaquiniana*	SC/--/1B	Mason's lilaeopsis *Lilaeopsis masonii*	SC/SR/1B
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	--/--/1B	Sebastopol meadowfoam *Limnanthes vinculans*	E/E/1B
Sonoma sunshine *Blennosperma bakeri*	E/E/1B	Mt. Diablo cottonweed *Micropus amphibolus*	--/--/3
Tiburon Indian paintbrush *Castilleja affinis* ssp. *neglecta*	E/T/1B	Marsh microseris *Microseris paludosa*	--/--/1B
Suisun thistle *Cirsium hydrophyllum*	E/--/1B	Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	--/--/1B
Point Reyes bird's-beak *Cordylanthus maritimus* ssp. *palustris*	SC/--/1B	Gairdner's yampah *Perideridia gairneri* ssp *gairdneri*	SC/--/1B
Soft bird's-beak *Cordylanthus mollis* ssp *mollis*	E/CR/1B	North Coast semaphore grass *Pleuropogon hooverianus*	--/R/2
Dwarf downingia *Downingia pusilla*	--/--/2	Marin knotweed *Polygonum marinense*	SC/--/3
Tiburon buckwheat *Eriogonum luteolum* var. *caninum*	--/--/3	Rayless ragwort *Senecio aphanactis*	--/--/2
Fragrant fritillary *Fritillaria liliacea*	SC/--/1B	Point Reyes checkerbloom *Sidalcea calycosa* ssp. *Rhizomata*	--/--/1B
Diablo rock rose *Helianthella castanea*	SC/--/1B	~~California sea blite~~ ~~*Suadia Californica*~~	~~E/--/3~~
Hayfield tarplant *Hemizonia congesta* ssp. *Leucocephala*	--/--/3	Showy Indian clover *Trifolium amoenum*	E/--/1B
Brewer's western flax *Hesperolinon breweri*	--/--/1B	Saline clover *Trifolium depauperatum* var. *hydrophilum*	--/--/1B
Santa Cruz tarplant *Holocarpha macradenia*	T/E/1B		

[1] Status explanations:

Federal
- E = listed as endangered under the federal Endangered Species Act.
- T = listed as threatened under the federal Endangered Species Act.
- SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.
- -- = no listing.

State
- E = listed as endangered under the California Endangered Species Act.
- T = listed as threatened under the California Endangered Species Act.
- R = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
- -- = no listing

CNPS
- 1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
- 2 = List 2 species: plants rare, threatened, or endangered in California but more common elsewhere.
- 3 = List 3 species: plants about which more information is needed to determine their status.

5.2 Environmental Impacts and Mitigation Measures

5.2.1 Methodology and Significance Criteria

Potential impacts of the project on vegetation resources were characterized qualitatively by evaluating direct, indirect, temporary, and permanent impacts. Direct impacts include the direct removal of vegetation within the footprints of ground-disturbing actions such as levee breaches. An indirect impact results from changes to habitat that are incidental to project implementation. An example would be the establishment of a nonnative invasive weed species because of ground disturbance during project implementation, and the weed species outcompeting native vegetation.

Temporary impacts have a short duration, and the vegetation would be expected to recover within a few years after implementation. An example would be the removal of vegetation to repair or redesign a water pump or inlet structure, and vegetation recolonizing the repair site. A permanent impact would involve the long-term alteration of habitat quality and vegetation because the project would result in the removal or change in the vegetation type. An example would be the permanent removal of a levee section that currently supports vegetation, or the conversion of lower tidal marsh habitat to middle or upper marsh habitat.

Criteria based on the State CEQA Guidelines ~~and the NEPA Guidelines~~ were used to determine the significance of vegetation impacts. The following general criteria were considered in determining whether an impact on botanical, wetland, and wildlife resources would be considered significant:

- federal or state legal protection of the resource or species,
- federal or state agency regulations and policies,
- documented resource scarcity and sensitivity both locally and regionally, and
- local and regional distribution and extent of biological resources.

The project would have a significant impact on botanical resources if it would result in

- substantial reduction in local population size attributable to direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of plant species that are
  - listed as endangered, threatened, or proposed for listing under CESA or ESA;
  - listed as rare under CNPPA; or
  - qualified as rare or endangered under CEQA; or

- the removal or alteration of substantial portions of a sensitive vegetation community, any vegetation community of particular public or regulatory concern, or other natural vegetation community, such that the viability of the community is threatened in the project area or vicinity.

5.2.2 No-Project Alternative

5.2.2.1 Impact V-1: Loss of Common and Sensitive Vegetation Communities and Special-Status Plants as a Result of Levee Failure and Emergency Repairs

The No-Project Alternative would result in direct impacts on vegetation in the event of a levee failure and during emergency repairs. Levee failure and related repair activities would remove vegetation in the failed section and in adjacent areas used for construction-related repair actions. Vegetation types that may be affected include lower, middle, and upper tidal marsh on the outboard sides of levees and common vegetation types on the levee structures. Slough channel scouring and erosion because of levee failure may indirectly affect tidal marsh vegetation and populations for several special-status plant species that may occur in outboard levee habitats. These special-status species include Suisun marsh aster, Delta tule pea, Marin knotweed, California cord grass, and Mason's liliaeopsis. The federally listed soft bird's-beak is considered unlikely to occur in areas of potential levee failure and adjacent slough channels. No populations of special-status plants are reported from the areas within or adjacent to areas of potential levee failure (Figure 5-1).

The loss of common or sensitive communities from isolated or localized failures is not expected to result in the substantial loss of these habitat types and is not expected to jeopardize the existence of these habitat types in the project area and vicinity. For this reason, and because this alternative would result in no project being implemented, this impact is considered less than significant. No mitigation is required.

The loss of individuals or portions of populations of Suisun marsh aster, Delta tule pea, Marin knotweed, California cord grass, and Mason's liliaeopsis as a result of levee failure is not expected to substantially reduce the population size of these species in the project vicinity, and is not likely to threaten the viability of these species in the project area or contribute to a trend toward listing these species. Potential habitat for these species occurs throughout the project area and vicinity, and levee failures are expected to remove only a small fraction of potentially suitable habitat. Moreover, the project area is outside the main distribution area of these species, and the loss of a local population is not expected to affect the overall population size or distribution of these species. Therefore, this impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

5.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

5.2.3.1 Impact V-2: Temporary Alteration of Common Vegetation and Sensitive Communities

The installation of water intakes, outlets, and other water control structures would result in a direct, permanent impact on vegetation in the area of ground disturbance, channel excavation, and other construction activities. This option would remove small portions of sensitive tidal marsh habitat and, depending on the location of the structures, may directly and indirectly affect special-status plant populations. The loss of individuals or portions of populations of Suisun marsh aster, Delta tule pea, Marin knotweed, and California cord grass as a result of the installation of water intakes, outfalls, and levee maintenance would not substantially reduce the population size of these species in the project vicinity and is not likely to threaten their viability in the project area or contribute to a trend toward listing them. Moreover, the project area is outside the main distribution of these species, and the loss of a local population is not expected to affect the species' overall population size or distribution. Therefore, this impact is considered less than significant. No mitigation is required.

5.2.3.2 Impact V-3: Removal of Soft Bird's-Beak

The installation of water intakes and outlets and other ground-disturbing work may directly and indirectly affect soft bird's-beak, a federally listed endangered plant species historically reported to occur in the project area. Erosion of slough channels may indirectly affect soft bird's-beak by altering outboard levee tidal marsh habitats. None of the proposed water control structures would be located in the vicinity of the single historical population reported in the project area at the confluence of Dutchman Slough and South Slough, and erosion of slough channels and adjacent outboard tidal marsh habitat is not predicted to occur in this area.

Unidentified populations of this species may be directly affected by ground disturbance associated with installation, maintenance, and repair activities and indirectly affected by habitat modification that would result from localized channel scouring adjacent to intake or outlet structures. In addition, this option may create conditions favorable to the establishment of peppergrass and other exotic species that would prevent soft bird's-beak from colonizing restored habitats and reoccupying its historical range. Because of the small number of extant populations and the limited distribution of soft bird's-beak, the loss of any individuals or populations as a result of construction activities, slough erosion, or exotic species invasion is considered substantial. Therefore, this impact is considered significant. Implementation of Mitigation Measure V-1 would reduce this impact to a less-than-significant level.

Mitigation Measure V-1: Avoid Ground Disturbance in Populations of Soft Bird's-Beak

The project sponsors will conduct preconstruction botanical surveys to USFWS protocols to map and inventory any populations of soft bird's-beak in the area of ground disturbance and the surrounding area that would be directly and indirectly affected by construction, maintenance, repairs, and slough channel scouring. If no populations of soft bird's-beak are located in the affected habitats, the project would have no impact on this species, and no additional mitigation is required. If populations are found, the site of the structures and ground disturbance will be relocated, if feasible, to avoid direct and indirect impacts on the identified populations and individuals. Implementation of this mitigation measure is expected to avoid adverse impacts on soft bird's-beak. If it is not feasible to avoid adverse effects on individuals or occupied habitat for soft bird's-beak while still meeting the purpose and need of the project, the project sponsors will consult with USFWS and DFG under Section 7 of ESA and the CNPPA, respectively, to develop appropriate impact avoidance measures or additional mitigation measures.

5.2.3.3 Impact V-4: Removal of Other Special-Status Species

Installation and operation of water control structures may directly and indirectly affect other special-status plant species in the area of ground disturbance, including Delta tule pea, Mason's lilaeopsis, Marin knotweed, San Joaquin spearscale, California cord grass, and Suisun Marsh aster. The extent of ground disturbance is expected to be small relative to the amount of existing habitat and populations of these special-status species in the project area and vicinity.

The direct or indirect loss of individuals or a portion of a population of Delta tule pea, Mason's lilaeopsis, Marin knotweed, San Joaquin spearscale, California cord grass, and Suisun Marsh aster is not expected to be substantial and would not be extensive enough to threaten the viability of these species in the project area or vicinity. Project actions are not expected to substantially reduce the availability of suitable habitat for these species. The restoration of tidal marsh habitat in abandoned salt ponds would result in a long-term, permanent substantial increase in the area and connectivity of potential habitat for these species in the project area. Therefore, this impact is considered less than significant. No mitigation is required.

5.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts on vegetation under Salinity Reduction Option 1B (Impacts V-2, V-3, and V-4) are nearly the same as those under Salinity Reduction Option 1A. Breaching Pond 3 would require less construction, but the breach could result in

direct effects on outboard marsh areas that are breached, and an indirect loss of tidal marsh habitat near the breaches because channel scouring would erode some portions of outboard levee tidal marsh habitat. However, levee lowering also would increase lower marsh vegetation colonization opportunities. The impact determinations and associated mitigation measures, however, are the same as those under Salinity Reduction Option 1A.

5.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts on vegetation under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1A for Impacts V-2, V-3, and V-4. Breaching Pond 3 and 4/5 would require less construction, but the breach could result in direct effects on outboard marsh areas that are breached and an indirect loss of tidal marsh habitat near the breaches because channel scouring would erode some portions of outboard levee tidal marsh habitat. However, levee lowering also would increase lower marsh vegetation colonization opportunities. The impact determinations and associated mitigation measures, however, are the same as those under Salinity Reduction Option 1A.

5.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts on vegetation under Salinity Reduction Option 2 (Impacts V-2, V-3, and V-4) are nearly the same as those under Salinity Reduction Option 1A. Installation of a siphon between Pond 6 and Pond 2 would result in similar temporary effects on vegetation. The impact determinations and associated mitigation measures, however, are the same as those under Salinity Reduction Option 1A.

5.2.7 Water Delivery Option

The Project Component of the Water Delivery Option has been designed to use existing pipelines, roads, disturbed road margins, and railroad corridors as much as possible to reduce impacts on special-status species and sensitive and natural vegetation communities.

5.2.7.1 Impact V-2: Temporary Alteration of Common Vegetation and Sensitive Communities

Water Delivery Project Component (Sonoma Pipeline)

Construction-related impacts associated with the Sonoma Pipeline would include

- direct removal of vegetation during grading, trenching, and jack-and-boring,
- direct disturbance of vegetation during any off-road vehicle trips, and
- indirect disturbance of wetland hydrology through alterations in topography resulting from soil compaction by construction equipment or backfilling of the pipe trench.

The Sonoma Pipeline would include trenching and related construction activities for a new segment of pipeline and the installation of pump stations. New construction on the Sonoma Pipeline would begin in the Schellville area, just south of SR 12/121. The initial portion of the pipeline will cross ruderal and grazed bayland (Figure 5-1). The Sonoma Pipeline alignment crosses seven streams; however, jack-and-bore or other trenchless construction methods would be used to pass the pipeline beneath the streams to avoid direct effects on sensitive resources, including wetlands.

A portion of the new segment of pipeline would also extend through a section of the Huichica Creek Unit of the NSMWA; consequently, construction activities may affect tidal marsh habitat. Construction on the Huichica Creek Unit of the NSMWA would include the use of jack-and-bore or other trenchless methods to avoid or minimize impacts on sensitive marsh habitat.

Direct impacts on special-status plant species and indirect impacts on wetlands and other sensitive habitats that may occur in the construction area are considered significant. Therefore, this impact is considered significant. Implementation of Mitigation Measure V-2 would reduce this impact to a less-than-significant level.

Mitigation Measure V-2: Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures

Before final plans are completed for pipeline design and construction, SCWA will complete an initial biological survey, jurisdictional determination, and wetlands delineation to confirm the presence/absence of special-status plant species and sensitive habitats along the route. If these resources occur, the impact avoidance and minimization measures described below will be implemented. If avoidance and minimization measures still result in impacts, additional mitigation measures described below will be implemented to reduce overall impacts to a less-than-significant level.

Preconstruction surveys will be conducted by qualified biologists with the necessary permits from state and/or federal resources agencies and will be completed during the appropriate survey season. The results of the investigations will be submitted to, and/or otherwise coordinated with, USFWS and DFG. If

wetlands under state or federal jurisdiction occur in the construction areas and involve the placement of fill or dredged materials or other alteration, the necessary and appropriate permits and approvals from responsible resources agencies will be secured. As appropriate for the type of permit to be considered, options that avoid, minimize, or mitigate potential impacts on jurisdictional wetlands will be evaluated.

Avoidance or impact reduction measures will include, but not be limited to, the use of jack-and-bore or other trenchless methods to reduce the need for surface construction within identified sensitive habitats and exclusion zones, and the restriction of construction activities and vehicles to a specified ROW. For areas where it is not feasible to completely avoid construction-related impacts on special-status species or sensitive habitats, one or more of the following measures will be implemented as necessary:

- Exclusion zones and buffer areas will be used where practicable and feasible to avoid construction impacts on identified sensitive vegetation. Where avoidance is not possible, minimizing ground disturbance to the extent practicable and feasible will reduce impacts. The locations of habitats and species to be avoided will be clearly identified in the contract documents (plans and specifications).
- Preproject topography will be restored.
- Construction activities in wetlands will be restricted to the dry season.
- Before clearing and grubbing commences, construction and staging areas will be flagged to clearly define the limits of the work area. These areas will be clearly identified on the contract documents (plans and specifications).
- Sensitive areas outside of the construction corridor will be so labeled on construction documents (plans and specifications) as "Sensitive Biological Resources—Do Not Disturb."
- Where possible, trenches will be worked from only one side to minimize impacts on adjacent habitat.
- Watering of exposed earth will be conducted consistent with good construction practices to minimize dust production.
- Construction zones at or within 50 feet of wetland areas will be temporarily fenced with 6-foot chain link fencing and posted with "No Trespassing" signs. Fence posts will be driven, not cemented, into the ground. Fence breaks will be provided at channel crossings. All fencing will be removed upon completion of that phase of construction.
- A qualified biologist will be on-site to observe construction activities as appropriate when construction in or adjacent to sensitive habitat occurs.
- Contractors awarded contract packages will sign a document stating that they have read, agree to, and understand the required resource avoidance measures, and will have construction crews participate in a training on sensitive vegetation resources.

In areas of special-status species and sensitive habitats where direct and indirect impacts cannot be reduced to a less-than-significant level by the above measures, SCWA will consult with USFWS and/or DFG to design and implement additional mitigation measures such as the following:

- reseeding the trench line with native vegetation appropriate for the affected habitat type and/or using a double-trenching technique through wetland habitat to help preserve the existing seedbank; and
- if impact avoidance is not possible, mitigating in the form of on-site or off-site habitat restoration/revegetation, or purchase of mitigation bank credits.

Water Delivery Project Component (Napa Pipeline)

Construction-related impacts associated with the Napa Pipeline would be the same as listed above for the Sonoma Pipeline. The Napa Pipeline would include jack-and-bore or other trenchless technology for the first segment of pipeline that crosses the Napa River. New construction on the Napa Pipeline would begin on the east bank of the Napa River just north of the Napa WWTP. The entry pit of the pipeline would be excavated in upland habitat on the east bank, posing little potential for impacts on any extant special-status plant species. The exit pit of the pipeline would be excavated in potentially sensitive habitat on the west bank, resulting in the potential for impacts on any extant special-status plant species found adjacent to the Napa River. The next portion of the first segment of pipeline would extend through the Stanly Ranch in grassland habitat, and possibly portions of diked historic baylands that support marsh habitats. Consequently, construction activities would affect this habitat, also posing the potential for impacts on any resident special-status species therein. Once across the Stanly Ranch, the remainder of Segment 1 and the entire portion of Segment 2 would be constructed within roadways, avoiding sensitive vegetation and habitats.

Direct impacts on special-status plant species and indirect impacts on wetlands and other sensitive habitats that may occur in the construction area are considered significant. Therefore, this impact is considered significant. Implementation of Mitigation Measure V-2 would reduce this impact to a less-than-significant level.

Water Delivery Project Component (CAC Pipeline)

The CAC Pipeline would begin at the CAC WWTP and proceed north in Mezzetta Court until it intersects with Green Island Road. At this point the CAC Pipeline would turn northwest and run beneath Green Island Road, passing through upland/grassland and vineyard habitat, developed areas, and inactive salt crystallizer beds.

The final segment of the CAC Pipeline would use an existing pipeline that extends between the inactive salt drying beds and the salt ponds west of the Napa River. This pipeline segment does not require new construction. No impacts on

special-status plants or sensitive habitats are expected to occur along the CAC Pipeline. Therefore, impacts are considered less than significant.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined. However, the potential future pipelines from the LGVSD, Novato SD, and City of Petaluma WWTPs are anticipated to parallel roadways, railroads, and eventually turn east across the Wingo and Ringstrom Bay Units of the NSMWA. Construction of these routes may affect several habitat types: open water, upland (agriculture, ruderal, and urban), tidal marsh, disturbed marsh/leveed baylands, and seasonal wetlands. Impacts on these habitats are expected to be temporary and limited to construction-related activities. This impact is considered significant. Implementation of Mitigation Measure V-2, "Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures," would reduce this impact to a less-than-significant level. This measure is described under "Water Delivery Project Component (Sonoma Pipeline)" above.

5.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 (Impacts V-2, V-3, and V-4) are nearly the same as those under Salinity Reduction Options 1A and 1B, except that this option could result in slough erosion and site-specific vegetation removal associated with levee breaching and restoration. The impact determinations and associated mitigation measures, however, are the same as those under Salinity Reduction Option 1A. Additional impacts are described below.

5.2.8.1 Beneficial Impact V-5: Long-Term Enhancement of Common Vegetation and Sensitive Communities

Habitat restoration would result in a substantial increase in subtidal habitat, intertidal mudflat, and middle marsh over the long-term. The increase in these habitats would provide greater habitat diversity, complexity, extent, and connectivity compared to existing conditions. Substantial new habitat for common vegetation and sensitive communities for plants and plant-dependent wildlife would be created. The restoration of these habitats would create a complex and diverse marsh ecosystem similar to the ecosystem that previously existed in the northern San Pablo Bay. This impact is considered beneficial. No mitigation is required.

5.2.8.2 Impact V-6: Short-Term Impacts on Common Vegetation and Sensitive Communities

After the initial breaching of the levees, Ponds 3 through 5 would be open to substantial tidal exchange and the restoration process would begin. In general, the slough channels are expected to erode fairly quickly, with approximately 100 acres of the fringe lower marsh and middle marsh along the sloughs and Napa River eroding within 5 years, an additional 90 acres within 10 years, and 40 acres within 20 years (240 acres total); however, these losses would be largely offset by the formation of new marsh. The extent of marsh erosion compared to the 1850 historical shoreline varies by slough. In some sloughs, the channel is predicted to remain narrower than the historical channel. In others, the channel may~~is predicted to~~ widen beyond the historical size, sometimes beyond the corridor defined by the adjacent levees in the vicinity of Dutchman Slough.

Lower marsh vegetation is expected to colonize quickly, primarily in Pond 3, creating approximately 50 acres of new lower marsh habitat by year 5 and 260 acres of additional new lower marsh habitat by year 10. Middle marsh habitat would also become established quickly. Approximately 100 acres of additional new habitat would form by year 5, 500 acres of additional new habitat by year 30, and approximately 1,170 acres of additional new middle marsh habitat would form by year 50.

The estimated net result is a temporary loss of middle marsh habitat of 90 acres after 10 years and 100 acres after 20 years. However, this trend would be reversed between years 20 and 30 when no net loss is expected within 30 years, and a net increase of approximately 1,000 acres is expected within 50 years (Figure 2-16 and Table 2-2).

The temporary deficit of middle marsh habitat would be offset by the restoration of a surplus of lower marsh habitat, and the project ultimately would result in a substantial, long-term increase in the availability and connectivity of middle marsh habitat in the project area.

These changes in habitat types and locations simulate natural systems and evolution. Though some of these changes would occur quickly, over a 5–30 year period, they are expected to occur in a timeframe that would allow the dispersal and reestablishment of common and sensitive communities. Furthermore, the monitoring and adaptive management program proposed in the project description would ensure that potential adverse effects are minimized. Therefore, this impact is considered less than significant. No mitigation is required.

5.2.8.3 Impact V-7: Invasion of Nonnative Species

Restoring the abandoned salt ponds would create conditions favorable to the establishment of invasive, nonnative species of cord grass, including smooth cord grass (*Spartina ~~alternifloia~~ alterniflora*), Chilean cord grass (*S. densiflora*), and salt-meadow cord grass (*S. patens*). The project would create extensive areas of

lower tidal marsh habitat that is most suitable for smooth cord grass, which poses the greatest competitive threat to the native California cord grass and other native tidal marsh plant species. Higher elevation habitats at the base of retained levees or on design structures may provide habitat for other exotic species of pepperweed.

The risk of nonnative cord grass species invading and becoming established in the project area increases with the number of other populations in the project vicinity and with the length of time required for native plant colonization. Populations adjacent to the project area are likely seed sources; therefore, the best predictor of native and nonnative cord grass colonization of a restoration site is the distribution of cord grasses in the project vicinity. One of the best remaining stands of native California cord grass occurs at Coon Island, adjacent to Ponds 4, 5, 7, and 8. California cord grass was the only species of cord grass recorded during the monitoring of the restoration of Pond 2A (1998–2000). Nonnative cord grass species, however, are known to occur in the surrounding region and have potential to quickly invade and dominate new marsh habitat. Smooth cord grass is considered the most invasive and is especially prevalent in San Francisco Bay. A four-foot diameter population of a nonnative cordgrass was recently reported from ~~the project area~~ in Pond 2A and was removed immediately by applying an herbicide.

Recent restoration experience in Pond 2A indicates that native California cord grass is considered the most likely cord grass species to become established in the project area. Nonetheless, the potential for invasion of nonnative cord grass is considered high because the long project duration increases the probability that an invasive, nonnative species could become established in the project area or vicinity. Nonnative species would outcompete natives, prevent native habitat restoration, and adversely affect wildlife habitats; therefore, this impact is considered significant. Implementation of Mitigation Measure V-3 would reduce this impact to a less-than-significant level.

Pepperweed is well established in the project area and vicinity on higher elevation habitats such as upper tidal marsh and adjacent levee structures. Marsh restoration, including levee breaches and grading, would reduce the suitable habitat for pepperweed in the project area. The project is not expected to create conditions favorable to the expansion of pepperweed; therefore, this impact is considered less than significant. No mitigation is required.

Mitigation Measure V-3: Monitor and Manage Invasive Exotic Plant Species

The project sponsors will coordinate with existing programs, particularly the Introduced Spartina Project, to monitor and manage nonnative invasive cordgrass species. If nonnative cordgrass becomes established in the project area, the project sponsors will support eradication efforts including periodic hand removal or chemical treatment of small populations, and implementing other adaptive management measures to minimize conditions favorable to the establishment of nonnative species.

5.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 (Beneficial Impact V-5 and Impacts V-2, V-3, V-4, V-6, and V-7) are nearly the same as those under Habitat Restoration Option 1, except that this option could result in more slough erosion and site-specific vegetation removal associated with levee breaching, and that substantially greater tidal marsh habitat would be created in the long run. The impact determinations and associated mitigation measures, however, are the same as those under Habitat Restoration Option 1.

5.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Beneficial Impact V-5 and Impacts V-2, V-3, V-4, V-6, and V-7) are nearly the same as those under Habitat Restoration Option 1, except that this option could result in less slough erosion and site-specific vegetation removal because fewer ponds would be restored. This would maintain more of the existing habitats, but would not reestablish the habitat diversity historically provided in the project area. The impact determinations and associated mitigation measures, however, are the same as those under Habitat Restoration Option 1.

5.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 (Beneficial Impact V-5 and Impacts V-2, V-3, V-4, V-6, and V-7) are nearly the same as those under Habitat Restoration Option 1, except that this option would result in

- site-specific vegetation removal associated with increased levee lowering ~~breaching earlier in the project~~,
- a greater probability of accelerated tidal marsh habitat formation, and
- decreased probability of nonnative species invasion because of the accelerated tidal marsh habitat creation.

The impact determinations and associated mitigation measures, however, are the same as those under Habitat Restoration Option 1.

Chapter 6
Biological Resources—Wildlife

6.1 Environmental Setting

6.1.1 Introduction and Sources of Information

This chapter describes the wildlife resources in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information on existing conditions is derived from the following sources:

- *Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements for Key Plants, Fish, and Wildlife* (Goals Project 2000);
- *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds, San Francisco Bay Estuary, 2000 Progress Report* (Takekawa et al. 2000);
- *Napa Salt Ponds Biological Resources* (Lewis Environmental Services and Wetlands Research Associates 1992);
- *The Natural Resources of Napa Marsh; Coastal Wetland Series #19* (Madrone Associates 1977);
- Status and Trends Report on Wildlife of the San Francisco Estuary (U.S. Fish and Wildlife Service 1992);
- *Species List for the Napa River Salt Pond Restoration Project, Napa and Solano Counties, California (1-1-02-SP-0065)* (U.S. Fish and Wildlife Service 2001);
- *Rarefind2: California Natural Diversity Database* (California Department of Fish and Game 2001);
- *State of the Estuary* (Association of Bay Area Governments 1992); ~~and~~
- Draft Subsequent Environmental Impact Report, March 1986, Wastewater Reclamation and Disposal Facilities (Landon, Wheeler, and Weinstein 1986)~~.~~;
- Stanly Ranch Specific Plan Draft EIR (Brady/LSA, August 1998); and

- Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration (Napa Sanitation District, January 11, 1995).

6.1.2 Regulatory Setting

Several state and federal agencies have regulatory authority or responsibility over project-related activities that affect biological resources. Table 6-1 summarizes project-related activities, the type of resource affected, and the government agency with regulatory authority over the activity.

Table 6-1. Summary of Regulatory Setting for Wildlife Resources

Project-Related Activity	Regulatory Authority
Alteration of stream channel, bed, or bank, including dredging or discharge of fill	DFG, permitting authority under Section 1601 (Lake or Streambed Alteration Agreement) of the California Fish and Game Code
Effects on species or the habitat of species listed or candidates for listing under ESA	USFWS and NMFS, formal consultation and permitting authority under Section 7 of ESA
Effects on species or the habitat of species listed or candidates for listing under CESA	DFG, consultation and permitting authority under Section 2081 of CESA
Effects on animals fully protected in California	DFG, permitting authority under California Fish and Game Code Sections 3511 [birds], 4700 [mammals], and 5050 [amphibians and reptiles], 5515 [fish])
Effects on birds of prey, their nests, and eggs	DFG, permitting authority under California Fish and Game Code Section 3503.5
Effects on other special-status species, including species of concern and CNPS-listed plants	DFG and USFWS, responsible agencies to review EIR and EIS

6.1.2.1 Federal

The regulatory setting for wildlife resources under the following is nearly the same as that described in Section 5.1.2.1 in Chapter 5, "Biological Resources—Vegetation":

- ESA,
- CWA Section 404, and
- Executive Order 11990—Protection of Wetlands.

In addition, the federal regulatory requirements described below apply to wildlife resources.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 USC 661 *et seq.*) requires consultation with USFWS when the waters of any stream or other body of water are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled or modified under a federal permit or license. Most USFWS comments on applications for permits under Section 404 of the CWA or Section 10 of the RHA are conveyed to the Corps through the consultation process required by this coordination act.

USFWS provides advisory comments and recommends mitigation measures to avoid impacts on wetlands or modify activities that may directly affect wetlands. Mitigation recommended by USFWS may include restoring or creating habitat to avoid a net loss of wetland functions and values. Although consultation with USFWS is required, the Corps is not required to implement USFWS recommendations.

USFWS prepared a Planning Aid Report in 1997 and has prepared a Fish and Wildlife Coordination Act Report (CAR) that documents the habitat effects, including benefits, anticipated as a result of the proposed project and project options.

Migratory Bird Treaty Act and Executive Order 13186—Conservation of Migratory Birds

The MBTA (16 USC 703–711) prohibits the take of any migratory bird or any part, nest, or eggs of any such bird. Under the act, *take* is defined as pursuing, hunting, shooting, capturing, collecting, or killing, or attempting to do so. This act applies to all persons and agencies in the United States, including federal agencies. Construction of all project options would comply with provisions of the MBTA.

Executive Order 13186 (January 11, 2001) requires that any project with federal involvement address impacts of federal actions on migratory birds. The order is designed to assist federal agencies in their efforts to comply with the MBTA and does not constitute any legal authorization to take migratory birds. The order also requires federal agencies to work with USFWS to develop a memorandum of understanding (MOU). Protocols developed under the MOU must promote the conservation of migratory bird populations by

- avoiding and minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions;
- restoring and enhancing habitat of migratory birds, as practicable; and
- preventing or abating the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

6.1.2.2 State

The regulatory setting for wildlife resources under the following is nearly the same as that described in Section 5.1.2.2 in Chapter 5, "Biological Resources—Vegetation":

- CEQA,
- CESA,
- California State Wetlands Conservation Policy, ~~and~~
- RWQCBs~~.~~, and
- Fish and Game Code Section 1600 *et seq.*

In addition, the state regulatory requirements described below apply to wildlife resources.

California Fish and Game Code

Fully Protected Species

Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) identify fish and wildlife species for which DFG may not authorize take, except for scientific research; these species are collectively referred to as *fully protected* species. The four sections specify that

> no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected [bird], [mammal], [reptile or amphibian], [or fish], and no such permits or licenses heretofore issued shall have any force or effect for any such purpose...

Sections 3503 and 3503.5

Section 3503 of the California Fish and Game Code specifies that

> It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.

Section 3503.5 of the code specifies that

> It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.

~~Section 1600 *et seq.*~~

~~DFG has jurisdictional authority over wetland resources associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600–1607. DFG has the authority to regulate all work under the jurisdiction of the State of~~

~~California that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. Activities of agencies that are project proponents are regulated under Section 1601. Activities of private individuals who are project proponents are regulated under Section 1603.~~

~~In practice, DFG marks its jurisdictional limit at the top of the stream or lake bank or the outer edge of the riparian vegetation, where present, and sometimes extends its jurisdiction to the edge of the 100-year floodplain. Because riparian habitats do not always support wetland hydrology or hydric soils, wetland boundaries, as defined by Section 404, sometimes include only portions of the riparian habitat adjacent to a river, stream, or lake. Therefore, jurisdictional boundaries under Section 1600 *et seq.* may encompass a greater area than that regulated under Section 404.~~

~~DFG enters into a lake or streambed alteration agreement with a project proponent and can impose conditions on the agreement to ensure that no net loss of wetland values or acreage will be incurred. The lake or streambed alteration agreement is not a permit, but rather a mutual agreement between DFG and the project proponent.~~

~~The project sponsors would prepare a lake or streambed alteration agreement for the proposed project.~~

6.1.2.3 Special-Status Species

Special-status wildlife species are legally protected under CESA and ESA or other regulations and are considered sufficiently rare by the scientific community to qualify for such listing. For the purpose of this report, the term *special-status wildlife* refers to species that

- are listed or proposed for listing as threatened or endangered under ESA (~~50 CFR 17.12 [listed plants],~~ 50 CFR 17.11 [listed animals], and various notices in the *Federal Register* [proposed species]);
- are candidates for possible future listing as threatened or endangered under ESA (61 FR 40:7596–7613, February 28, 1996);
- are listed or proposed for listing as threatened or endangered under CESA (14 CCR 670.5);
- meet the definition of rare or endangered under CEQA (CEQA Guidelines, Section 15380) and for which certain impacts (e.g., removal of rookery habitat) could be considered significant under CEQA;
- are wildlife species of special concern (SSC) to DFG (Remsen 1978 [birds], Williams 1986 [mammals], Jennings and Hayes 1994 [amphibians and reptiles], and Moyle et al. 1995 [fish]);

- are wildlife species of concern (SC) to USFWS (this designation has no legal status; however, ~~NEPA and~~ CEQA requires that federal SCs be considered in environmental analyses);
- are animals fully protected in California (California Fish and Game Code, Sections 3511 [birds], 4700 [mammals], 5050 [reptiles and amphibians], and 5515 [fish]);
- are nesting raptors protected in California (California Fish and Game Code, Section 3503.5); and
- are mammals protected under the Marine Mammal Protection Act.

6.1.3 Regional Setting

The Napa River Unit is an integral part of the Bay-Delta estuary. It comprises approximately 1,600 square miles, drains more than 40% of the state, provides drinking water to 22 million people, and irrigates 4.5 million acres of farmland. The estuary provides habitat for a rich diversity of flora and fauna. Two-thirds of the state's salmon and nearly half the birds migrating along the Pacific Flyway pass through the Bay-Delta. A variety of unique endemic birds and small mammals, including the California clapper rail *(Rallus longirostris obsoletus)*, California black rail *(Laterallus jamaicensis)*, saltmarsh song sparrow (*Melospiza melodia*), and salt marsh harvest mouse (*Reithrodontomys raviventris*) also occur almost exclusively in this ecosystem.

The existing Bay-Delta estuary, however, is only a small remnant of a former vast aquatic ecosystem that once defined the bay, including a network of more than 80 islands and hundreds of miles of channels. Extensive land conversions during the Gold Rush of 1848 and in the more than 150 years since then have resulted in the loss of 85-90% of the Bay-Delta's historical wetlands. Hydraulic mining during the Gold Rush filled the rivers, bays, and marshes with more than 1 billion cubic yards of sediment. Subsequent reclamation of marshlands for agriculture and urban development has resulted in the loss of more than 750 square miles of tidal marsh. Construction of dams and diversion of water to cities and farms have also dramatically altered the hydrology and biology of the remaining wetlands. The existing level of contamination in the estuary today is also high enough to impair the health of the ecosystem (San Francisco Estuary Institute 2000a) and numerous introduced nonnative plants and animals now compete with the native flora and fauna for very limited resources.

6.1.4 Project Setting

The Napa River Unit borders the northern edge of San Pablo Bay and includes estuarine reaches of the Napa and Sonoma Rivers (see Figure 2-1). The area was historically all marsh and slough but was subsequently largely converted to commercial salt ponds. These ponds are still operative, but are no longer used to commercially produce salt. The 9,460-acre Napa River Unit consists of 7,190

acres of salt ponds and levees and 2,270 acres of fringing marsh, restored marsh, and sloughs. More than 150 wildlife species, including birds, mammals, reptiles, amphibians, and terrestrial invertebrates use the habitats of the Napa River Unit. The areas to the north and east of the Napa River Unit, within which the Sonoma Pipeline, Napa Pipeline, and CAC Pipeline are proposed for the Water Delivery Option, include many of the same wildlife species as the marsh plus wildlife species associated with the grassland, agricultural, and ruderal habitats that occur outside the marsh. The habitats in the Napa River Unit and nearby areas to the northwest and east and biological descriptions of the representative wildlife species that use them are presented below.

6.1.4.1 Habitats and Species

Wildlife habitats and species in the project area include open water, salt evaporation ponds, mudflats, levees, vegetated and unvegetated tidal marsh, disturbed marsh/leveed baylands, seasonal wetlands, windbreaks, human-made structures, and uplands.

The Napa River Unit includes mostly open water, salt ponds, mudflats, levees, and tidal marsh habitats. The study areas of the pipelines currently proposed for the Water Delivery Option span or parallel portions of the Hudeman Slough Mitigation and Enhancement Wetlands (HSMEW) (see Section 5.1.4, "Project Setting," in Chapter 5), the Ringstrom Bay and Huichica Creek Units of the NSMWA, and portions of the City of American Canyon sphere of influence and include three habitat types: disturbed marsh/leveed baylands, seasonal wetlands, and upland.

Open Water

Open-water habitat is the habitat that contains water year-round, typically of depths more than 3 feet, and is rich in phytoplankton and zooplankton that provide food for birds, fish, and benthic invertebrates. San Pablo Bay, the Napa River, and the major sloughs in the project site contain open-water habitat.

San Francisco Bay, including San Pablo Bay and the Napa River Unit, is one of the most important staging areas and wintering areas for Pacific Flyway migratory waterfowl. Hundreds of thousands of birds use the San Francisco Bay area annually. Canvasback (*Aythya valisineria*), greater and lesser scaup (*Aythya affini, A. marila*), and ruddy duck (*Oxyura jamaicensis*) are the most abundant waterfowl in the project area. Between January 1999 and November 2000 more than 280,000 birds were recorded using the salt ponds. Canvasbacks are an important species in the area because a substantial portion of their population winters in San Francisco Bay. Approximately 25% of all canvasbacks in North America are found along the Pacific Flyway in January, and the majority of these are found in San Francisco Bay and its associated marshes and estuaries (Carter et al. 1990).

Salt Ponds

While no longer used to commercially make salt, the salt ponds still retain a gradient of salt concentrations representative of the former conditions in the ponds. At certain times of the year, these conditions favor establishment of large populations of invertebrates and phytoplankton that, in turn, support a rich diversity (80 species) of birds in some of the ponds with less saline conditions. The types of birds that use the ponds are correlated with the water depth, salinity, and sizes of the ponds. In shallow ponds, shorebirds including American avocet (*Recurvirostra americanus*), black-bellied plover (*Pluvialus squatarola*), black-necked stilt (*Himantopus mexicanus*), and willet (*Catoptrophorus semipalmatus*) and dabbling ducks predominate; in deeper ponds, diving ducks such as scaup, common goldeneye (*Bucephala clangula*), bufflehead (*B. albeola*), and ruddy duck are more prevalent. In ponds with low salinity (15–50 ppt), pelicans, terns, cormorants, egrets, and dabbling and diving ducks are common. In ponds with higher salinity (75–200 ppt), grebes, phalaropes, plovers, gulls, and diving ducks are common. Water depth and salinity also affect fish and invertebrate populations; these factors are discussed in Chapter 7, "Biological Resources—Aquatic Resources."

Mudflats

The mudflats of San Francisco Bay, including San Pablo Bay and the Napa River Unit, are important foraging and resting habitats for many species of migratory and wintering shorebirds and waterfowl. The bay mudflats are composed of fine-grained silts and clays and are found along the bay/Napa River side of perimeter saltmarsh habitat that is outboard of the pond levees. They are exposed twice daily during low tide and extend from approximately 3 feet below ~~MSL~~ MTL to 1 foot above ~~MSL~~ MTL. Narrow bands of mudflat are also found at the same elevations along margins of subtidal channels in the tidal marshes. The mudflats are largely barren of vegetation, with limited benthic algae, but support a rich invertebrate fauna that provides food for both shorebirds and waterfowl. Shorebirds that typically use these mudflats include long-billed curlew (*Numenius americanus*), marbled godwit (*Limosa fedoa*), dunlin (*Calidris alpina*), least and western sandpiper (*Calidris minutilla, C. mauri*), and long-billed and short-billed dowitcher (*Limnodromus scolopaceus, L. griseus*) (Small 1994). A variety of dabbling ducks, diving ducks, and terns also roost on mudflats during low tide. Mudflats adjacent to tidal marshes are important foraging habitat for a number of special-status species including the California clapper rail, California black rail, and San Pablo song sparrow (*Melospiza melodia samuelis*).

Levees

Levees enclose all of the ponds in the project area. These human-made structures provide important upland nesting, refuge, and resting habitat for a diversity of birds, including American avocet, black-necked stilt, Caspian tern (*Hydroprogne*

caspia), gulls, and various waterfowl. The western burrowing owl (*Athene cunicularia hypugea*), a federal and state species of concern, occasionally uses levees in the upland transition region for nesting. The levees are also used by some reptiles, such as the western fence lizard (*Sceloporus occidentalis*), small mammals, and ground-feeding granivorous passerines such as the white-crowned sparrow (*Zonotrichia leucophrys*).

Tidal Marsh

Existing tidal marsh habitat is limited in the project area, occurring mostly south of SR 37. Tidal marsh habitat in the project area outside of Pond 2A is restricted to "fringe marsh" habitat (i.e., between the levees and slough channels), largely on accreted sediments. However, many acres of this habitat would be restored with implementation of the project. This habitat can be divided into three distinct zones based on the frequency and duration of tidal inundation:

- *Lower marsh* occupies the elevations between MTL and MHW (3.3–5.5 feet NAVD 88) and is inundated daily. This habitat is generally dominated by California cord grass~~ and bulrush~~.
- *Middle marsh* occupies the elevations between MHW and MHHW (5.5–6.0 feet NAVD 88) and is dominated by common pickleweed~~ and some bulrush~~. The marshplain is inundated frequently throughout each month, but for shorter periods than is lower marsh.
- *Upper (high transitional) marsh* occupies the elevations between MHHW and the highest tide level (>6.0 feet NAVD 88). This habitat is inundated infrequently and for short periods during higher high tides. It occurs primarily as a narrow strip along the bayside of the levees and supports plant species that are tolerant of saline conditions but not adapted to frequent, long-term inundation~~, including saltgrass, alkali heath, fat hen, saltplant, and gumplant~~.

The tidal marsh community provides food, cover, and breeding habitat for numerous marsh-dependent wildlife species. The dense vegetation and large invertebrate populations typically associated with salt marshes provide ideal nesting and foraging conditions for a variety of bird species, including rails, egrets, herons, waterfowl, and shorebirds. In addition to being important habitat for wetland-associated wildlife, the salt marshes are also a crucial component of the San Pablo Bay ecosystem, providing nutrients and organic matter to the mudflats and open water of the bay. These in turn are important habitats for a variety of waterfowl, shorebirds, and other waterbirds as described above. Wildlife species characteristic of the marshlands in the project area include double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba)*, American coot (*Fulica americana*), killdeer (*Charadrius vociferus)*, northern harrier (*Circus cyaneus)*, and San Pablo song sparrow. Other species that probably use the marshes include raccoon (*Procyon lotor)*, mallard (*Anas platyrhynchos)*, sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and willet.

Disturbed Marsh/Leveed Baylands

The marsh areas of the north bay region have often been leveed to create additional land, primarily for agriculture. These areas are considered disturbed marsh and continue to exist as several subhabitats, including reclaimed marsh, leveed seasonal marsh, and leveed permanent marsh. These vegetation communities provide habitat for invertebrates such as the blood worm and crayfish; fish such as the mosquitofish and carp; waterfowl, shorebirds, wading birds, and raptors; reptiles such as the western pond turtle (*Clemmys marmorata*), gopher snake (*Pituophis melanoleucus*), and garter snake; amphibians such as the Pacific treefrog (*Pseudacris regilla*) and bullfrog (*Rana catesbeiana*); and mammals such as the salt marsh harvest mouse, deer mouse (*Peromyscus maniculatus*), house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), black-tailed jackrabbit (*Lepus californicus*), opossum (*Didelphis virginiana marsupialis*), skunk, coyote (*Canis latrans*), California vole (*Microtus californicus*), ornate shrew (*Sorex ornatus*), and gray fox (*Urocyon cinereoargenteus*).

Seasonal Wetlands

Seasonal wetlands function as wetlands during the rainy season and uplands during the dry season. They typically form in shallow depressions throughout the area. Seasonal wetlands are frequently found along road and railroad corridors where adjacent swales and drainage ditches are created to aid in controlling stormwater runoff. Invertebrate species such as brine shrimp, seed shrimp, copepods, and water fleas are adapted to the parched-to-flood hydrologic regime exhibited by seasonal wetlands. During the dry season, the seasonal wetlands essentially function as uplands for vertebrates.

Numerous species are commonly found in wetlands and ponds along the Sonoma Pipeline route. These include greater scaup duck, ruddy duck, Canada goose (*Branta canadensis)*, mallard, gadwall (*Anas strepera*), northern pintail (*Anas acuta*), green-winged teal (*Anas erecca*), northern shoveler (*Anas clypeata*), cinnamon teal (*Anas cyanoptera*), American avocet, black-necked stilt, long and short-billed dowitchers, greater yellowlegs (*Tringa melanoleuca*), godwit, long-billed curlew, and killdeer.

Western and least sandpipers (*Calidris mauri, C. minutilla*) are observed during the fall and winter. Bufflehead, eared grebe (*Podiceps nigricollis*), pied-billed grebe (*Podilymbus podiceps*), double-crested cormorant, and ring-necked ducks are often observed in deeper ponds, particularly in the winter months.

The American coot can be found in substantial numbers at the HSMEW (Kirven Associates 1996). Black rails can be found in the Petaluma Marsh. There is potential habitat for clapper and black rails along both proposed pipelines. Virginia rails occur at Ringstrom Bay and Huichica Creek.

The HSMEW also provides sightings of American and lesser goldfinches (*Carduelis tristis, C. psaltria*); barn, cliff, and violet-green swallows (*Hirundo rustica, Petrochelidon pyrrhonota, Tachycineta thalassina*); black and Say's phoebes (*Sayornis nigricans, S. saya*); common yellowthroat (*Geothlypis trichas*); house finch (*Carpodacus mexicanus*); loggerhead shrike (*Lanius ludovicianus*); marsh wren (*Cistothorus palustris*); northern mockingbird (*Mimus polyglottos*); savannah and song sparrows (*Passerculus sandwichensis, Melospiza melodia*); western kingbird (*Tyrannus verticalis*); western meadowlark (*Sturnella neglecta*); American pipit (*Anthus rubescens*); ring-necked pheasant (*Phasianus colchicus*); mourning dove (*Zenaida macroura*); horned lark (*Eremophila alpestris*); and Brewer's, red-winged, and tri-colored blackbirds (*Euphagus cyanocephalus, Agelaius phoeniceus, A. tricolor*) (Kirven Associates 1996).

Possible reptile and amphibian inhabitants in the HSMEW grassland include western fence lizard, southern alligator lizard (*Elgaria multicarinatus*), gopher snake, common kingsnake (*Lampropeltis getulus*), and common garter snake. Reptile and amphibian species present in the grasslands along the Napa Pipeline alignment include western fence lizard, western skink (*Eumeces skiltonianus*), southern alligator lizard, common kingsnake, common garter snake, gopher snake, western toad (*Bufo boreas*), and sometimes the northwestern pond turtle (*Clemmys marmorata marmorata*) (Envicom Corp. 1994).

Windbreaks and Human-Made Structures

Windbreaks are linear or grouped plantings of trees that were intended to provide protection from high winds. Although they are not a naturally occurring habitat, they provide additional habitat diversity in the project area that is used for nesting and shelter by a variety of resident and migrating birds. They are composed of eucalyptus trees on Pond 5 and between Ponds 2 and 6, and provide nesting habitat for double-crested cormorant and herons (Madrone Associates 1977). These trees may also provide nesting habitat and foraging perches for different raptors including red-shouldered hawk (*Buteo lineatus*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus lecurus*), and great horned owl (*Buteo virginianus*). Human-made structures such as pump houses and outbuildings found in the project area may also offer protection to nesting barn owl (*Tyto alba*), swallows (*Hirundinidae*), black phoebe, and roosting bats.

Upland

Grassland/Agricultural/Ruderal

Most of the upland habitat within the north bay region has been converted to agriculture, including oat hay, pastureland, and more recently, vineyards. These areas support a mixture of native and nonnative vegetation in the form of annual grasses, herbs, and wildflowers, along with oat hay and grapevines. A variety of wildlife can be found within grassland and agricultural uplands. Reptile species include the gopher snake, common kingsnake, garter snake, rattlesnake, western pond turtle, western skink, southern alligator lizard, and western fence lizard.

Amphibian species include western toad, Pacific treefrog, and bullfrog. Birds may include California quail (*Callipepla californica*), killdeer, Brewer's blackbird, red-winged blackbird, cattle egret (*Bubulcus ibis*), turkey vulture (*Cathartes aura*), red-tailed hawk, pheasant, dove, crow, raven, house finch, and western meadowlark. Trees, especially in the form of eucalyptus windrows, provide valuable habitat for raptors. Mammals may include black-tailed jackrabbit, cottontail, pocket gopher, deer mouse, house mouse, California vole, California ground squirrel (*Spermophilus beecheyi*), and mule deer (*Odocoileus hemionus*), as well as the following predators: coyote, fox, bobcat (*Lynx rufus*), raccoon, opossum, and skunk.

Raptors appearing during surveys within the HSMEW include the American kestrel, white-tailed kite, northern harrier, barn owl, short-eared owl, and red-tailed hawk (Kirven Associates 1996). In the winter it is not unusual to observe burrowing owl, juvenile golden eagles (*Aquila chrysaetos*), prairie and peregrine falcons (*Falco mexicanus, F. peregrinus*), and merlins (*F. columbarius*) in this same area.

Grasslands along the Napa Pipeline alignment serve as habitat for burrowing owl, turkey vulture, northern harrier, American kestrel, white-tailed kite, prairie falcon, horned lark, western meadowlark, and numerous songbirds (Envicom Corp. 1994).

Mammal species observed at the HSMEW include the California vole, western harvest mouse, house mouse, opossum, raccoon, coyote, black-tailed jackrabbit, and mule deer (Kirven Associates 1996). Mammal species with habitat in the grasslands along the Napa Pipeline alignment include brush rabbit, black-tailed jackrabbit, California ground squirrel, Botta's pocket gopher (*Thomomys bottae)*, western harvest mouse, California vole, long-tailed weasel (*Mustela frenata)*, coyote, and mule deer (Envicom Corp. 1994). Similar common wildlife are found in the upland/grassland habitat adjacent to the CAC pipeline.

6.1.4.2 Special-Status Wildlife

Numerous special-status wildlife species have been documented to occur, or have the potential to occur, in the project area and in suitable habitat types in the vicinity of the project area. These species are listed in Table 6-2 along with their listing status, geographic distribution, habitat requirements, and potential to be affected by the project. Biological information on those species for which there is a potential for adverse impact from the proposed project alternatives is presented below.

6.1.4.3 Aquatic Invertebrates

Information on the status and biology of special-status aquatic invertebrates known to occur, or with potential to occur, in the project area is presented in Chapter 7, "Biological Resources—Aquatic Resources."

Table 6-2. Special-Status Wildlife Species with Potential to Occur in the Project Area and Vicinity

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Invertebrates						
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County; isolated populations also in Riverside County	Common in vernal pools; also found in sandstone rock outcrop pools	Habitat loss to agricultural and urban development	Moderate—one CNDDB record from Napa County Airport in 2000	No
California freshwater shrimp *Syncaris pacifica*	E/E	Coastal lowland streams in Napa, Marin, and Sonoma Counties	Streams	Introduced predators, summer dam construction, instream gravel mining	None	No
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds	Habitat loss to agricultural and urban development	Low	No
Monarch butterfly (wintering sites) *Danaus plexippus*	--/--	Throughout California	Overwinters in coastal Monterey pine, Monterey cypress, and eucalyptus groves in California	Habitat loss and alteration	Moderate—roosting habitat only	No
Callippe silverspot butterfly *Speyeria callippe callippe*	E/--	San Bruno Mountain, San Mateo County; and a single location in Alameda County	Open hillsides where wild pansy (*Viola pendunculata*) grows; larvae feed on Johnny jump-up plants, whereas adults feed on native mints and nonnative thistles	Habitat loss and alteration	Low	No
Myrtle's silverspot butterfly *Satyrium auretorum fumosoum*	E/--	Historically known from San Mateo County north to the mouth of the Russian River in Sonoma County. No butterflies have been observed recently at the known population sites near Pacifica and San Mateo in San Mateo County	Inhabits coastal terrace prairie, coastal bluff scrub, and associated nonnative grassland habitats where the larval foodplant, *Viola* sp. occurs	Habitat loss and alteration	Low	No

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Opler's longhorn moth *Adela opleri*	SC/--	Marin County and Oakland area on the inner Coast Ranges south to Santa Clara County. One record from Santa Cruz County	Serpentine substrates that support the host plant, cream cups (*Platystemon californicus*)	Habitat loss and alteration	Low	No
Fish—see "Biological Resources—Aquatic Resources" chapter						
Amphibians						
California red-legged frog *Rana aurora draytoni*	T/SSC	Found along the coast and coastal mountain ranges of California from Marin County to San Diego County; Sierra Nevada (middle elevations [above 1,000 feet] from Butte County to Fresno County)	Permanent and semipermanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods	Loss and degradation of habitat from development, livestock grazing, and recreational activity; introduction of exotic predators	Moderate—designated critical habitat west of study area	No
Reptiles						
Northwestern pond turtle *Clemmys marmorata marmorata*	SC/SSC	In California, range extends from Oregon border of Del Norte and Siskiyou Counties south along coast to San Francisco Bay, inland through Sacramento Valley, and on the western slope of Sierra Nevada; range overlaps with that of southwestern pond turtle through the Delta and Central Valley to Tulare County	Woodlands, grasslands, and open forests; occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation	Loss and alteration of aquatic and wetland habitats, habitat fragmentation	Low	No

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Birds						
White-faced ibis (rookery site) *Plegadis chihi*	SC/SSC	Both resident and winter populations on the Salton Sea and in isolated areas in Imperial, San Diego, Ventura, and Fresno Counties; breeds at Honey Lake (Lassen County), at Mendota Wildlife Management Area (Fresno County), and near Woodland (Yolo County)	Prefers freshwater marshes with tules, cattails, and rushes, but may nest in trees and forage in flooded agricultural fields, especially flooded rice fields	Has declined in California and stopped breeding regularly, probably from destruction of extensive marshes required for nesting	None	No
Double-crested cormorant (nesting colony) *Phalacrocorax auritus*	--/SSC	Winters along the entire California coast and inland over the Coast Ranges into the Central Valley from Tehama County to Fresno County; a permanent resident along the coast from Monterey County, and the islands off San Francisco; also breeds in the San Francisco Bay area and in Yolo and Sacramento Counties	Rocky coastlines, beaches, inland ponds, and lakes; needs open water for foraging, and nests in riparian forests or on protected islands, usually in snags	Loss of coastal and riparian breeding sites, human disturbance	High	No
American bittern *Botaurus lentiginosus*	SC/--	Breeds throughout length of the state, west of the Sierra Nevada, and in suitable habitat in southern portion of its range	Freshwater marshes, and occasionally salt marsh	Population has declined from draining of marshes, human disturbance, and pesticides (Arbib 1979); overgrazing of emergent vegetation also is detrimental	Moderate	No
~~Great egret (rookery)~~ ~~*Ardea alba*~~	~~--/--~~	~~Breeds the entire length of the state, withdrawing from northeastern portions in winter~~	~~Coastal salt and freshwater marshes and lagoons, mudflats, river and lake margins~~	~~Intrusions of humans into nesting colonies often cause parents to desert nests; many former nesting colonies have been abandoned. Wetland drainage has markedly reduced available habitat~~	~~High~~	~~No~~

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
~~Snowy egret (rookery)~~ ~~*Egretta thula*~~	~~--/--~~	~~Occurs over most of the state, less commonly in the northern portions~~	~~Coastal lagoons, saltwater marshes, bays, estuaries, freshwater marshes, lakes, rivers, and streams.~~	~~At Salton Sea, numbers of nesting individuals have declined, apparently from competition with cattle egrets for nest sites. Probably similar to the great egret: highly sensitive to human intrusions into nesting colonies, and to pesticides~~	~~High~~	~~No~~
~~Black-crowned night-heron (rookery)~~ ~~*Nycticorax nycticorax*~~	~~--/--~~	~~Breeds over the length of the state~~	~~Saltwater and freshwater marshes~~	~~Corvidae and other predators eat eggs. Numbers have been reduced from drainage of marshes and swamps, and cutting of trees, but this species is more adaptable and persistent than most other ardeids~~	~~High~~	~~No~~
~~Great blue heron (rookery)~~ ~~*Ardea herodias*~~	~~--/--~~	~~Breeds the entire length of the state. Does not breed in eastern portion of state except Salton Sea and Colorado River area~~	~~Saltwater and freshwater marshes, estuaries, mudflats, freshwater lakes, and rivers~~	~~Sensitive to human disturbance near nests, and probably to pesticides and herbicides in nesting and foraging areas. Populations in California increased between 1970 and 1978~~	~~High—two documented rookeries in study area~~	~~No~~
White-tailed kite *Elanus leucurus*	--/FP	Lowland areas west of Sierra Nevada from head of Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging	Loss of grassland and wetland habitats to agriculture and urban development	High	No
Ferruginous hawk *Buteo regalis*	SC/SSC	Does not nest in California; winter visitor along the coast from Sonoma County to San Diego County, eastward to the Sierra Nevada foothills and southeastern deserts, the Inyo-White Mountains, the plains east of the Cascade Range, and Siskiyou County	Open terrain in plains and foothills where ground squirrels and other prey are available	Young may be preyed upon by golden eagles and great horned owls. Competes with the numerous avian and mammal species that prey upon small mammals.	Low—winter foraging only	No

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Northern harrier *Circus cyaneus*	--/SSC	Throughout lowland California; has been recorded in fall at high elevations	Grasslands, meadows, marshes, and seasonal and agricultural wetlands providing tall cover	Loss of habitat to agricultural and urban development	High	Yes
Merlin *Falco columbarius*	--/SSC	Does not nest in California; rare but widespread winter visitor to the Central Valley and coastal areas	Forages along coastlines, open grasslands, savannas, and woodlands; often forages near lakes and other wetlands	Unclear; possibly chemical contamination and illegal take of young	High—winter migrant only	No
Black rail *Laterallus jamaicensis coturniculus*	SC/T	Permanent resident in the San Francisco Bay area and eastward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations	Loss of wetland habitat	High	Yes
California clapper rail *Rallus longirostris obsoletus*	E/E	Marshes around the San Francisco Bay area and east to Suisun Marsh	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickleweed; feeds on mollusks removed from the mud in sloughs	Loss of wetland habitat and predation by nonnative predators, shooting	High	Yes
Western snowy plover (coastal populations) *Charadrius alexandrinus nivosus* (nesting)	T/SSC (Coastal)	Population defined as those birds that nest adjacent to or near tidal waters, including all nests along the mainland coast, peninsulas, offshore islands, and adjacent bays and estuaries. Twenty breeding sites are known in California from Del Norte to San Diego County	Coastal beaches above the normal high-tide limit in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent	Human disturbance on nesting beaches, feral animal and nonnative predator disturbance, loss of habitat	High	Yes

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Long-billed curlew *Numenius americanus*	--/SSC	Nests in northeastern California in Modoc, Siskiyou, and Lassen Counties. Winters along the coast and in interior valleys west of Sierra Nevada	Nests in high-elevation grasslands adjacent to lakes or marshes. During migration and in winter, frequents coastal beaches and mudflats and interior grasslands and agricultural fields	Breeding range has retracted considerably in the last 80 years, but western populations have not decreased as much as those in eastern U.S.	High—foraging only	No
~~Caspian tern (nesting colony)~~ ~~*Sterna caspia*~~	~~-/-~~	~~Nesting colonies are located at south San Francisco Bay, San Diego Bay, and several lakes in Modoc and Lassen Counties; small colonies recently reported on Humboldt Bay, San Pablo Bay, and Elkhorn Slough (Monterey County)~~	~~Nests in dense colonies on sandy estuarine shores, on levees in salt ponds, and on islands in alkali and freshwater lakes~~	~~Nest predation~~	~~Moderate—historical breeder in area, current summer migrant only~~	~~Yes~~
Short-eared owl *Asio flammeus*	--/SSC	Permanent resident along the coast from Del Norte County to Monterey County although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts	Predators include great horned owls, golden eagles, snowy owls, and peregrine falcons. Small, predatory mammals and large reptiles may prey upon young and eggs. Competitors include northern harriers, gulls, barn owls, and other large owls	High—foraging only	No
Western burrowing owl *Athene cunicularia hypugea*	SC/SSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Level, open, dry, heavily grazed or low-stature grassland or desert vegetation with available burrows	Loss of habitat, human disturbance at nesting burrows	Low—documented from Tubbs Island	No

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Vaux's swift *Chaetura vauxi*	--/SSC	Coastal belt from Del Norte County south to Santa Cruz County and in mid-elevation forests of the Sierra Nevada and Cascade Range	Nests in hollow, burned-out tree trunks in large conifers	Sometimes heavily parasitized by lice, which can cause considerable mortality	High—foraging only	No
Willow flycatcher *Empidonax traillii*	SC/E	Summers along the western Sierra Nevada from El Dorado to Madera County, in the Cascade and northern Sierra Nevada in Trinity, Shasta, Tehama, Butte, and Plumas Counties, and along the eastern Sierra Nevada from Lassen to Inyo County	Riparian areas and large wet meadows with abundant willows. Usually found in riparian habitats during migration	Frequently parasitized by brown-headed cowbird. Formerly bred commonly in willow thickets throughout most of lowland and montane California, but numbers have declined drastically in recent decades because of cowbird parasitism and habitat destruction. Heavy grazing of willows by livestock apparently reduces numbers	Moderate	No
Salt marsh common yellowthroat *Geothlypis trichas sinuosa*	SC/SSC	Found only in the San Francisco Bay area in Marin, Napa, Sonoma, Solano, San Francisco, San Mateo, Santa Clara, and Alameda Counties	Freshwater marshes in summer and salt or brackish marshes in fall and winter; requires tall grasses, tules, and willow thickets for nesting and cover	Loss of marsh breeding habitat	High	Yes
San Pablo song sparrow *Melospiza melodia samuelis*	SC/SSC	Found in San Pablo Bay area	Uses tidal sloughs in pickleweed marshes; requires tall bushes (usually grindelia) along sloughs for cover, nesting, and songposts; forages over mudbanks and in the pickleweed	Loss of marsh breeding habitat	High	Yes

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Tricolored blackbird *Agelaius tricolor*	SC/SSC	Largely endemic to California; permanent residents in the Central Valley from Butte County to Kern County; at scattered coastal locations from Marin County south to San Diego County; breeds at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland; probably requires water at or near the nesting colony; requires large foraging areas, including marshes, pastures, agricultural wetlands, dairies, and feedlots, where insect prey is abundant	Loss of wetland and upland breeding habitats from conversion to agriculture and urban development and to water development projects, pesticides contamination, human disturbance of nesting colonies	Moderate—foraging only	Yes
California horned lark *Eremophila alpestris*	SSC	Found throughout California, but less common in mountain regions and on the North Coast	Common in a variety of open habitats with sparse vegetation. Found from grasslands along the coast and deserts near sea level to alpine dwarf-shrub habitat above treeline. Migrates to lower elevations in the winter and from out of state.	Loss of habitat	High	Yes

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Mammals						
Pale Townsend's (=western) big-eared bat *Corynorhinus townsendii pallescens*	SC/SSC	Klamath Mountains, Cascades, Sierra Nevada, Central Valley, Transverse and Peninsular Ranges, Great Basin, and the Mojave and Sonora Deserts	Mesic habitats; gleans insects from brush or trees and feeds along habitat edges	This species is extremely sensitive to disturbance of roosting sites. A single visit may result in abandonment of the roost. All known nursery colonies in limestone caves in California apparently have been abandoned. Numbers reportedly have declined steeply in California	Moderate—foraging only	No
Pacific Townsend's (=western) big-eared bat *Corynorhinus townsendii townsendii*	SC/SSC	Coastal regions from Del Norte County south to Santa Barbara County	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings. Very sensitive to disturbances and may abandon a roost after one on-site visit	This species is extremely sensitive to disturbance of roosting sites. A single visit may result in abandonment of the roost. All known nursery colonies in limestone caves in California apparently have been abandoned. Numbers reportedly have declined steeply in California	Moderate—foraging only	No
Yuma myotis *Myotis yumanensis*	SC/--	Common and widespread throughout most of California except the Colorado and Mojave deserts	Found in a wide variety of habitats from sea level to 11,000 feet, but uncommon above 8,000 feet. Optimal habitat is open forests and woodlands near water bodies	Sensitive to human disturbance of roosts, loss of habitat, and pesticides	Moderate—foraging only	No

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect
Pallid bat *Antrozous pallidus*	--/SSC	Occurs throughout California except the high Sierra from Shasta to Kern County and the northwest coast, primarily at lower and middle elevations	Occurs in a variety of habitats from desert to coniferous forest. Most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California. Relies heavily on trees for roosts	Very sensitive to disturbance of roosting sites. Such sites are essential for metabolic economy and juvenile growth and as night roosts to consume prey	Moderate—foraging only	No
Greater western mastiff bat *Eumops perotis californicus*	SC/SSC	Occurs along the western Sierra primarily at low to middle elevations and widely distributed throughout the southern coast ranges. Recent surveys have detected the species north to the Oregon border	Found in a wide variety of habitats from desert scrub to montane conifer. Roosts and breeds in deep, narrow rock crevices, but may also use crevices in trees, buildings, and tunnels	Sensitive to human disturbance of roosts, loss of habitat, and pesticides	Moderate—foraging and possible roosting in buildings	No
Suisun ornate shrew *Sorex ornatus sinuosus*	SC/SSC	Restricted to tidal marshes of the northern shores of San Pablo and Suisun Bays, both in Solano County	Tidal, salt, and brackish marshes containing pickleweed, grindelia, bulrushes, or cattails; requires driftwood or other objects for nesting cover	Loss of habitat, limited range and restricted habitat	Moderate—most recent CNDDB record in the area is from 1983	Yes
Salt marsh harvest mouse *Reithrodontomys raviventris*	E/E	San Francisco, San Pablo, and Suisun Bays	Salt marshes with a dense plant cover of pickleweed and fat hen; adjacent to an upland site	Habitat loss to urban development and salt production	High	Yes

Table 6-2. Continued

Common and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline	Likelihood of Occurrence in Study Area	Potential for Adverse Project Effect

[a] Status explanation:

Federal:

FE	=	Federally listed as endangered
FS	=	U.S. Forest Service sensitive species
FT	=	Federally listed as threatened
SC	=	Species of concern
--	=	No listing

State:

FP	=	State fully protected
SE	=	State-listed as endangered
SSC	=	Species of special concern
ST	=	State-listed as threatened
--	=	No listing

6.1.4.4 Terrestrial Invertebrates

Little is known about the terrestrial invertebrates in the Napa River Unit. No special-status invertebrates have documented occurrences in the project area. However, suitable roosting habitat for the migrating monarch butterfly (*Danaus plexippus*) is found in the eucalyptus trees on-site. However, this habitat should not be affected by proposed restoration actions for any of the alternatives.

6.1.4.5 Fish

Information on the status and biology of special-status fish known to occur, or with potential to occur, in the project area is presented in Chapter 7, "Biological Resources—Aquatic Resources."

6.1.4.6 Amphibians and Reptiles

Little is known about the amphibians and reptiles that occur, or could occur, in the Napa River Unit. The brackish and saline waters on-site are generally unsuitable for the red-legged frog (*Rana aurora draytoni*). The western pond turtle is not likely to occur in the project area for the same reason (Lewis Environmental Services and Wetland Research Associates 1992), although they could potentially be washed into the area during flood events (Wyckoff pers. comm.).

6.1.4.7 Birds

Caspian Tern (Nesting Colony)

Caspian tern is a migrant and summer visitor that forages primarily over the salt ponds in the project area. This species is known to nest on salt pond levees and islands in the San Francisco Bay area (Goals Project 2000). Historically, breeding colonies of Caspian terns have been recorded in the project area. However, this species is currently only a summer migrant to the area.

Northern Harrier

Northern harrier is a state species of special concern. It winters in and forages over marsh and grassland near the project area. Northern harriers are known to breed in the project area (Swanson pers. comm.).

California Black Rail

The California black rail is a state-listed threatened species and a federal species of concern. This species prefers pickleweed-dominated marsh habitat but also

occurs in freshwater and brackish marshes (Evens et al. 1991). Preferred breeding habitat includes areas of mature, higher-elevation marshes dominated by *Scirpus* and pickleweed. The species' reliance on tidally influenced, vegetated, elevated saltmarsh habitat makes it a valuable indicator species of mature, upper tidal marsh habitat (Goals Project 2000). California black rail occurs at a number of sites in the San Francisco Bay area, perhaps more concentrated in the northern part of the bay. The species will nest in higher areas of freshwater marshes, wet meadows, and salt marshes (Eddleman et al. 1994). Surveys conducted in 1976 (Manolis 1977) and 1988 (Evens et al. 1988) indicate that California black rails occur in the Napa River Unit. Indices of rail abundance (rails per census station) ranged from 0.11 in the area to the east of the intake channel along San Pablo Bay to 2.09 at the north mouth of South Slough. The area in and adjacent to the Napa River Unit has the highest relative density of black rails as well as the largest contiguous population in the San Francisco Bay area (Lewis Environmental Services and Wetland Research Associates 1992).

California Clapper Rail

The California clapper rail is both federally listed and state-listed as endangered. It is considered nonmigratory and occurs primarily in emergent salt marsh and brackish tidal marsh habitats with extensive areas of pickleweed, cord grass, saltgrass, alkali heath, jaumea, and rush. The network of tidal sloughs in the project area, being rich in tidal invertebrates, provides important foraging habitat (DeGroot 1927, Harvey 1988, Collins et al. 1994) and escape routes from predators (Zembal and Massey 1983; Foerster et al. 1990). Rail density appears to be positively correlated with channel density. Clapper rail nests are generally located along tidal channels in pickleweed-dominated marshes (Collins and Evens 1992). Gill (1979) surveyed the Napa River Unit for clapper rails and identified Dutchman Slough, Napa Slough, and Devil's Slough as having resident breeding populations. Gill estimated 1.0 rails/hectare (ha) at the Napa River Unit, compared to 1.4/ha in San Francisco Bay. Gill suggests that the Napa River Unit is a stronghold for the bay's clapper rail population. (Lewis Environmental Services and Wetland Research Associates 1992.)

Western Snowy Plover

The western snowy plover is federally listed as threatened and state-listed as a species of special concern. In 1975, Gill (reported in Page and Stenzel 1981) found three snowy plover nests on the internal levee of Pond 6. However, no plover nests were observed there in 1978 (Page and Stenzel 1981) or in 1989 (Carter et al. 1990). Nests and plovers have also been observed on levees and mudflats throughout the region, and there is a potential that they could again nest in the project area. Snowy plovers were observed in the project area in April 2002 at Pond 7 (Wyckoff pers. comm.). This species forages along the tidal flats and salt ponds. Roosting occurs along the levees of dry or partly dry salt ponds and sandy tidal flats. Nesting occurs on the ground on barren or sparsely vegetated salt pond levees and edges and along lagoon margins. Snowy plovers

move among the breeding, foraging, and roosting sites during all seasons (Goals Project 2000). Part of the San Francisco Bay population of snowy plovers is resident and part is migratory.

Salt Marsh Common Yellowthroat

The salt marsh common yellowthroat is a state and federal species of concern. It is believed to be a resident of coastal saltmarsh habitats from San Francisco Bay south to San Diego (Sibley 1952 in Goals Project 2000). In the bay region, approximately 60% of salt marsh common yellowthroats breed in brackish marsh, 20% in riparian woodland, 10% in freshwater marsh, 5% in salt marsh, and 5% in upland vegetation (Hobson et al. 1986; Shuford 1993). These birds are insectivorous, gleaning insects from low herbaceous vegetation, bushes, and small trees in the marshes and from the surface of the mud along associated channels (Goals Project 2000). In the San Francisco Bay area, salt marsh common yellowthroats winter in *Salicornia* marshes on the Skaggs Island complex and breed in adjacent brackish marshes (Foster 1977; Whisler pers. comm.).

Surveys by Hobson et al. (1986) and Foster (1977) indicate that the Napa River Unit has some of the highest breeding densities of salt marsh common yellowthroats in the Bay Area. The majority of the salt marsh common yellowthroat territories were in brackish marsh habitat. Territories included vegetation characterized by dense mixtures of salt-tolerant plants intermixed with freshwater plants.

San Pablo Song Sparrow

San Pablo song sparrow is a state and federal species of concern that is restricted to the salt marshes of San Pablo Bay (Grinnell and Miller 1944, Goals Project 2000). These birds generally inhabit regions of the salt marshes characterized by mixed salicornia/spartina vegetation along channels and numerous grindelia subshrub bushes that provide nesting sites and song perches (Goals Project 2000). San Pablo song sparrow is omnivorous, subsisting primarily on detritus-feeding insects, other invertebrates from intertidal mud, the maturing heads of grindelia flowers, and the fleshy fruits and tiny seeds of salicornia (Goals Project 2000). Records of occurrence for this species have been documented throughout the San Pablo Bay area, primarily in marsh vegetation along agricultural ditches and tidal channels (Goals Project 2000).

California Horned Lark

The California horned lark is a subspecies that is restricted to the coastal and coast range grasslands from southern Humboldt County south to San Diego as well as the San Joaquin Valley (Behle 1942, Grinnell and Miller 1944). It was considered a state species of special concern (Remsen 1978), but currently is not

in the current draft list of California Bird Species of Special Concern (CDFG and PRBO 2001). The horned lark forages on insects, spiders, snails, and grass and forb seeds. It breeds from March through July in grass-lined, cup-shaped nests in depressions on the ground.

American White Pelican

The American white pelican is a state species of special concern as a breeding species (Remsen 1978, CDFG and PRBO 2001). Nesting colonies are currently confined to the Klamath Basin in California (Shuford in prep.). Flocks of pelicans congregate at a few locations in the Bay Area during the non-breeding season (June through December) (Goals 2000), including the Napa Marshes (Carter et al. 1990 *cited in* Lewis Environmental Services and Wetland Research Associates 1992, Sterling pers. comm.). Pelicans prey upon fish in the tidal sloughs and Napa River, but will frequently roost in salt evaporation ponds and on dikes in the project area.

Double-Crested Cormorant

The double-crested cormorant was considered a state species of special concern (Remsen 1978), but currently is not in the current draft list of California Bird Species of Special Concern (CDFG and PRBO 2001). Populations had declined but have been recovering since the 1970s (Goals 2000). Double-crested cormorants build large, stick nest structures on powerline towers and on dead eucalyptus trees adjacent to tidal sloughs, the Napa River and salt ponds in the Napa Marshes region (Berner et al. 2003, Carter et al. 1990 *cited in* Lewis Environmental Services and Wetland Research Associates 1992, Sterling pers. comm.). They prey on fish and shrimp in ponds, tidal sloughs, open bay, lakes, reservoirs, and rivers throughout the Bay Area and in the nearshore of the Pacific Ocean.

Forster's Tern

The Forster's Tern breeds on coastal and inland wetlands, lakes and reservoirs throughout much of California. It forages for fish in marshes, ponds, tidal sloughs and rivers. This species nests in dirt scrapes alone or in colonies on bare islands and dikes at sites scattered throughout San Francisco/San Pablo Bay region (Goals 2000). Colonies of up to several hundred birds have been documented in the Napa Marsh region (Carter et al. 1990 *cited in* Lewis Environmental Services and Wetland Research Associates 1992, Goals 2000, Berner et al. 2003). The status and distribution of these colonies were unknown as of 1999 (Goals 2000). This tern's breeding season begins in April and lasts until August (Goals 2000).

6.1.4.8 Mammals

Suisun Ornate Shrew

The Suisun ornate shrew is a federal and state species of concern. It occurs only in the San Pablo and Suisun Bay areas and typically occupies saltwater and freshwater marshes, salt and fresh; low, dense vegetation adjacent to rivers, lakes, and streams; grassy hillsides; and chaparral slopes. It inhabits the dense, low-lying cover of salicornia and nests in wood, shrubs, and burrows. It feeds on insects, slugs, snails, centipedes, and occasionally on amphibians. Because of its restricted range, the Suisun ornate shrew is highly susceptible to habitat fragmentation.

Salt Marsh Harvest Mouse

The salt marsh harvest mouse is federally listed as threatened and state-listed as endangered. It is also fully protected under Section 4700 of the California Fish and Game Code.

There are two subspecies of salt marsh harvest mouse: the northern subspecies (*Reithrodontomys raviventris halicoetes*) in the San Pablo Bay area and the Napa River Unit and the southern subspecies (*R. r. raviventris*) in the San Francisco Bay area. The two subspecies exhibit subtle differences in biology and habitat use. *R. r. halicoetes* can tolerate fairly large fluctuations in marsh salinity where the average salinity is low (<22 ppt). In contrast, *R. r. raviventris* occurs in marshes where the salinity is high and more stable (27.0–31.2 ppt). The breeding season for *R. r. halicoetes* is May–November. This is shorter than the breeding season for *R. r. raviventris*, which is approximately March–November. (Shellhammer et al. 1982; Fisler 1965.)

Optimal habitat for the species consists of saline emergent wetland with thick, perennial plant cover consisting predominantly of pickleweed in association with fat hen and alkali heath (Goals Project 2000, Fisler 1965). To be suitable, salt marsh must have an upper border of peripheral halophytes (salt-tolerant plants) that offers refuge (escape habitat) during high tides or floods (Shellhammer et al. 1982). However, salt marsh harvest mice have been captured in less-than-optimal habitat, such as hypersaline areas and areas with 50% bare ground (Zetterquist 1978; Shellhammer et al. 1982), and will move into grasslands and bordering marshes in spring and summer months when maximum cover is present (Fisler 1965; Shellhammer et al. 1982).

The species' habitat use may also be affected by other rodent species. For example, in one study, salt marsh harvest mouse was found to use lower quality pickleweed habitat when California voles (*Microtus californicus*) were present in high numbers and to move to higher quality habitat when the vole population diminished (Geissel et al. 1988). Dispersal distances and the minimum patch size of suitable habitat needed to support populations of salt marsh harvest mouse are not well known. In one study, salt marsh harvest mice had a mean home range of

0.53 acre (2,133 square meters) (Bias and Morrison 1999). Salt marsh harvest mice have been observed crossing barriers such as narrow canals (up to 7 feet [2 meters] wide) and levee roads (up to 13 feet [4 meters] wide) and have been reported to swim sloughs up to 23 feet (7 meters) wide (Bias and Morrison 1999; Geissel et al. 1988). Geissel et al. (1988) also reported individuals traveling distances of 280 feet (85 meters) or more.

Habitat destruction is the greatest threat to salt marsh harvest mouse (U.S. Fish and Wildlife Service 1984). Approximately 85-90% of the Bay Area's tidal marshes have been lost to filling, flooding, or commercial conversion over the past 150 years (Goals Project 2000). In addition to habitat reduction, the salt marsh harvest mouse is threatened by flood control, mosquito abatement, marsh subsidence, changes in salinity, plowing, mowing, burning, and artificial flushing. All these conditions have adversely affected habitat quality by changing the composition of plant communities and/or reducing the vegetation required for cover (Shellhammer et al. 1982).

Salt marsh harvest mouse habitat in and near the project site includes the upper (high) marsh south of SR 37 and South Slough west of Pond 2A, including the accreted marsh on the inside bend of Ponds 2 and 2A. The most recently trapped area in the project site was the area along South Slough. Five salt marsh harvest mice, the northern subspecies (*R. r. halicoetes*), were captured in 2,385 trap nights from June 3 to June 5 in 1983 (Shellhammer 1983). Numerous trappings from the early 1970s and 1980s indicated relatively good populations south of SR 37. Captures on Fly Bay, the land between Pond 7 and Pond 8, also confirmed presence of this species. Overall, the narrow strips of tidal marsh surrounding the levees provide suitable habitat for this species. (Lewis Environmental Services and Wetland Research Associates 1992.)

6.2 Environmental Impacts and Mitigation Measures

6.2.1 Methodology and Significance Criteria

6.2.1.1 Analytical Methods

Impacts on wildlife were assessed by comparing the quantity and quality of aquatic and marsh habitats predicted to develop over time under the project options with aquatic and marsh habitat conditions under the No-Project Alternative. Wildlife species that occur or have potential to occur at the project site were presumed to be indirectly affected if the quantity or quality of habitats with which they are typically associated would be affected. Direct impacts on individual species were assessed qualitatively based on the likely sensitivity or susceptibility of the species to disruption as a result of activities that may be associated with construction (e.g., noise associated with equipment operation).

A major assumption is that conditions predicted to result with implementation of each habitat restoration option would occur within 50 years of project implementation. Predictions of future conditions are based largely on predicted rates of sediment accumulation and colonization of plants and effects of wave action on plant colonization. The actual rate at which nontidal and tidal wetland habitats would evolve and their distribution on the project site could be slower or faster because of uncertainties regarding the actual function and interaction of these parameters in tidal systems.

6.2.1.2 Impact Mechanisms

The following types of activities associated with project implementation could result in loss of or disturbance to aquatic and marsh-dependent habitats and associated species:

- operating equipment and conducting other construction activities, including construction of intakes and outfalls, grading down of levees in limited areas, levee maintenance, fill placement, excavation of channel breaches, and refurbishing or replacement of siphons (see Chapter 2, "Site Description, Options, and Alternatives");
- reintroducing tidal flow to currently nontidal lands; and
- performing management and maintenance activities necessary to maintain target habitats (e.g., activities associated with control of noxious weeds and invasive invertebrates), maintaining operation and integrity of infrastructure (e.g., water drainage and control structures), and controlling mosquito populations.

6.2.1.3 Thresholds of Significance

Criteria based on the State CEQA Guidelines were used to determine the significance of wildlife impacts. The project would have a significant impact on wildlife resources if it would

- result in a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS, with habitat modifications specifically considered significant if they would
  - substantially decrease the acreage or quality of intertidal and subtidal aquatic habitats,
  - substantially decrease the acreage or quality of tidal or nontidal wetlands,
  - substantially decrease the acreage or quality of waterfowl breeding or wintering habitat,

- substantially decrease the acreage or quality of migrant and wintering shorebird habitat, or
- result in the permanent loss of occupied special-status species habitat or the direct mortality of individuals of special-status species;

- result in a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by DFG or USFWS; or
- interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

The project would have a beneficial impact if it would result in a substantial increase in the quantity or quality of subtidal and intertidal aquatic and marshland habitat for wintering waterfowl, migrant and wintering shorebirds, or special-status species.

6.2.2 No-Project Alternative

6.2.2.1 Impact W-1: Long-Term Decline in Habitat Value and Function

Site conditions are expected to continue to deteriorate as salinity in the ponds closed to tidal influence continues to increase. DFG would manage the site to reduce day-to-day salinity, if possible, by adding water from the north and south, but there would be a net annual increase in the total salt load. The ponds would dry out more frequently as siphons become inoperable as a result of increased salinity gradients. Increasing the total salt load in the ponds would adversely affect resident and migrating wildlife by reducing habitat quality. This impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

6.2.2.2 Impact W-2: Temporary Disturbance of Wildlife

Noise, vibration, and visual disturbances associated with emergency levee repairs could adversely affect wildlife near the repair sites. For example, the federally listed and state-listed California clapper rail and California black rail could be affected during their breeding seasons. Disturbances could cause individuals to abandon their nests or young, resulting in a reduction of the breeding success of these species. This impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

6.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

6.2.3.1 Impact W-3: Construction-Related Disturbance and Mortality of Special-Status Species

Disturbances associated with construction or replacement of the intakes and outfalls and other improvements necessary to reduce salinity levels in the ponds could adversely affect birds nesting at and adjacent to construction sites. As indicated in Table 6-2, either special-status bird species have been observed to nest or suitable nesting habitat exists at and adjacent to the project site. These birds include California clapper rail, California black rail, snowy plover, northern harrier, Caspian tern, saltmarsh common yellowthroat, and San Pablo song sparrow. Construction disturbances, including noise and vibration, could cause individuals to abandon their nests or reduce the ability of adults to properly care for their eggs, thereby adversely affecting breeding success. Nesting birds located more than 150 feet from construction sites are unlikely to be adversely affected by construction because this distance should provide an adequate buffer from noise, vibration, and visual disturbances. Because potential nesting sites for these birds are located throughout the project area, construction activities could result in a substantial adverse direct effect on these species. Therefore, this impact is considered significant.

Similarly, construction of the salinity reduction facilities could result in the direct mortality of these bird species; nests with eggs or young birds could be crushed by construction equipment operating in the tidal marsh and on levees. Therefore, this impact is considered significant.

Implementation of Mitigation Measure W-1 would reduce this impact to a less-than-significant level.

Mitigation Measure W-1: Avoid Construction Activities near Nesting Habitats during Breeding Season

The project sponsors will avoid construction activities during the nesting period of the California clapper rail, California black rail, snowy plover, northern harrier, Caspian tern, saltmarsh common yellowthroat, and San Pablo song sparrow to the extent feasible. If construction activities must occur during nesting periods, the project proponents will conduct appropriate clearance surveys in the construction area as needed and determined by USFWS and DFG. Surveys will be conducted up to a distance at which birds are unlikely to be affected by project construction. This distance could vary according to terrain and type of construction activity, but is often 150 feet from the maximum limit of each construction site. If nests are located an adequate distance from the limits of construction, construction may proceed. If nest sites are located in areas that would be disturbed by construction, the project sponsors will consult with USFWS and/or DFG to determine what additional mitigation measures could be

implemented to avoid or reduce mortality (e.g., establishing buffers around active nest sites or sequencing construction to avoid potential impacts on these species during their breeding season) while allowing construction to proceed. These measures would reduce construction-related effects on nesting bird species to a less-than-significant level.

6.2.3.2 Impact W-4: Construction-Related Disturbance and Mortality of Salt Marsh Harvest Mouse and Suisun Ornate Shrew

Constructing pond intakes and outfalls, repairing levees, refurbishing or replacing siphons, and making other improvements necessary to reduce salinity levels in the ponds could adversely affect the salt marsh harvest mouse and the Suisun ornate shrew. Construction activities resulting in noise, vibration, and visual disturbances could cause individuals to abandon their burrows, foraging areas, and protective shelter. This disturbance could cause the species to become more susceptible to mortality from predation, physiological stress, or starvation. Similarly, operating construction equipment within the tidal marsh habitat could result in direct mortality. This impact is considered significant. Implementation of Mitigation Measures W-2 and W-3 would reduce this impact to a less-than-significant level.

Mitigation Measure W-2: Avoid Construction Activities near Occupied Suisun Ornate Shrew Habitat or Remove Shrews

Before constructing facilities within tidal marsh habitat, the project sponsors will conduct clearance surveys for the Suisun ornate shrew in the construction area as needed and determined by USFWS and DFG. If surveys indicate the presence of shrews, the project sponsors will consult with USFWS to identify appropriate methods for avoiding construction-related effects on the shrew. These methods may include installing exclusion fencing or trapping and relocating individuals.

Mitigation Measure W-3: Avoid Construction Activities near Occupied Salt Marsh Harvest Mouse Habitat

To the extent feasible, the project sponsors will avoid construction activities in or near marsh habitat suitable for the salt marsh harvest mouse. If construction activities must occur in this habitat, the project sponsors will consult with USFWS to determine appropriate methods for avoiding construction-related mortality of salt marsh harvest mice. These methods may include installing exclusion fencing or trapping and relocating individuals.

6.2.3.3 Impact W-5: Exposure of Wildlife to Contaminants during Construction

The soils of the Napa River Unit were established as a result of accretion of sediments from San Pablo Bay and the Napa River. Existing sediment contaminant loads largely reflect the influence of past and present agricultural activities, mining and industrial uses, and urban development. Contaminants known to be present in the waters and sediments of the Napa River and San Pablo Bay include heavy metals (lead, copper, aluminum, mercury, nickel, vanadium, chromium, silver, zinc), PAHs, PCBs, chlorinated hydrocarbon pesticides, and tributylin (TBT) (Tompson et al. 2000, Hornberger et al. 1999). These concentrations are not as high in the project area, as illustrated in Table 4-6 in Chapter 4. However, the sediments of both the Napa River and San Pablo Bay exceed sediment quality criteria for arsenic, chromium, copper, mercury, nickel, and total DDTs. The Napa River also exceeds sediment quality criteria for total chlordanes, and San Pablo Bay sediments exceed the criteria for total PAHs. The former Mare Island Naval Shipyard is also a potential point source of TBT, a highly toxic endocrine-disrupting chemical used as an antifoulant in ship paints.

Excavation for the intakes, outfalls, borrow ditches, and levee repairs and blasting proposed for the salinity reduction options could result in temporary remobilization of contaminated sediments. Remobilization could increase exposure of fish and wildlife to bioavailable contaminants. The effects of these contaminants on wildlife have not been fully quantified, and these effects could result in an ~~substantial~~ adverse effect on the natural marsh community or special-status species; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

6.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts W-3, W-4, and W-5) are nearly the same as those under Salinity Reduction Option 1A. Impacts on tidal marsh habitat would be slightly less than described under Salinity Reduction Option 1A because water intakes would not be constructed to connect Dutchman Slough and South Slough to Pond 3. Constructing these intakes would require operating equipment and excavation of tidal marsh.

6.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts W-3, W-4, and W-5) are nearly the same as those under Salinity Reduction Option 1A, except that there would be less construction than under even Salinity Reduction Option 1B.

6.2.6 Water Delivery Option

6.2.6.1 Impact W-3: Construction-Related Disturbance and Mortality of Special-Status Species

Water Delivery Project Component (Sonoma Pipeline)

Special-status species potentially affected by construction of the Sonoma Pipeline are listed in Table 6-3. Impacts on these species would occur only during construction. Impacts may include disturbance from project noise, harassment from construction activity and the presence of humans and equipment, and temporary modification of habitat during construction. Construction activities could also cause direct mortality of ground-dwelling special-status species by inadvertently striking them with construction equipment. This impact is considered significant. Implementation of Mitigation Measures W-4 through W-7 would reduce this impact to a less-than-significant level.

Table 6-3. Wildlife Species Potentially Affected by the Sonoma Pipeline

Species	Potential Location	Potential Impact	Mitigation Measures
Northwestern pond turtle *Clemmys marmorata marmorata*	Huichica Creek and the Huichica Creek Unit of the NSMWA	Noise disturbance, construction activity harassment, temporary modification of habitat, direct mortality	W-4, W-5, W-6, and W-7
California red-legged frog *Rana aurora draytoni*	Unknown, moderate likelihood of occurrence	Noise disturbance, construction activity harassment, temporary modification of habitat, direct mortality	W-4, W-5, W-6, and W-7
California clapper rail *Rallus longirostris obsoletus*	Napa, Hudeman, and Mud Sloughs; Flybay, and Edgerley and Coon Islands	Noise disturbance, construction activity harassment, temporary modification of habitat	W-4, W-5, and W-6
Saltmarsh common yellowthroat *Geothylpis trichas sinuosa*	Napa and Hudeman, Sloughs; Flybay, and Coon Island	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Western snowy plover (coastal populations) *Charadrius alexandruinus nivosus* (nesting)	Flybay	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Black rail *Laterallus jamaicensis coturniculus*	Flybay and Coon Island	Noise disturbance, construction activity harassment, temporary modification of habitat	W-4, W-5, W-6, and W-7
Double-crested cormorant (nesting colony) *Phalacrocorax auritas*	Pond 7 and Buchli Station Road	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
American bittern *Botaurus lentiginosus*	Unknown, moderate likelihood of occurrence	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Great egret (rookery) *Ardea alba*	Unknown, high likelihood of occurrence	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Snowy egret (rookery) *Egretta thula*	Unknown, high likelihood of occurrence	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Black-crowned night heron (rookery) *Nycticorax nycticorax*	NSMWA along Skaggs Island Road	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Great blue heron (rookery) *Ardea herodias*	Buchli Station Road	Noise disturbance, construction activity harassment	W-4, W-5, and W-6

Table 6-3. Continued.

Species	Potential Location	Potential Impact	Mitigation Measures
White-tailed kite *Elanus leucurus*	Huichica Creek Unit—NSMWA, high likelihood of occurrence	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Northern harrier *Circus cyaneus*	Lands adjacent to and north of Pond 7	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Merlin *Falco columbarius*	Unknown, high likelihood of occurrence during the winter	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Western burrowing owl *Athene cunicularia hypugea*	Huichica Creek Unit—NSMWA, moderate likelihood of occurrence	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Suisun song sparrow *Melospiza melodia maxillaries*	Unknown, moderate likelihood of occurrence	Noise disturbance, construction activity harassment, temporary modification of habitat	W-4, W-5, W-6, and W-7
Tricolored blackbird *Agelaius tricolor*	Pond surrounded by vineyards—Huichica Creek Unit—NSMWA	Noise disturbance, construction activity harassment	W-4, W-5, and W-6
Salt marsh harvest mouse *Reithrodontomys raviventris*	Flybay, Edgerley, and Coon Islands	Noise disturbance, construction activity harassment, temporary modification of habitat, direct mortality	W-4, W-5, W-6, and W-7

Mitigation Measure W-4: Complete Focused Surveys for Special-Status Wildlife Species before Construction

Before final plans are completed for pipeline design and construction, SCWA will conduct focused biological surveys along the segments of the Sonoma and Napa Pipelines, particularly around Schell Slough, in the HSMEW area, in the Huichica Creek Unit to determine the precise location sensitive wildlife species and associated habitat. The survey(s) will be conducted by a qualified biologist(s) having the necessary permits from state and/or federal resources agencies, and will be completed during the appropriate survey season. If necessary, and as appropriate, consultation on affected special-status species will be initiated with USFWS and/or DFG. Should sensitive wildlife species be found to exist in or near (i.e., within 100 feet) of the construction corridor, the impact avoidance/reduction measures identified in Mitigation Measure V-2, "Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures," described in Chapter 5, "Biological Resources—Vegetation," will be implemented as applicable to habitat for

sensitive wildlife species. In addition, the following measures will be implemented:

- At least 72 hours before vegetation clearing occurs, a preconstruction survey will be conducted by a qualified biologist to check for any active nests in or near the construction corridor. Should an active nest(s) be present, construction activities in the area of concern will be rescheduled or modified to avoid adverse impacts to the avian species occupying the nest.
- A qualified biologist will be present to monitor construction activities in and near areas known to be occupied by sensitive wildlife species, and will have the authority to install or require wildlife protection measures such as fencing (i.e., for nonavian species), noise buffers or noise level limitations during avian breeding seasons, and temporarily halting or redirecting construction activities to avoid direct impacts on sensitive species. The on-site biologist will have the required USFWS permit(s), or immediate access to a permitted biologist, should the handling of listed species be necessary.

Mitigation Measure W-5: Educate Construction Crews regarding Special-Status Wildlife Species

A qualified biologist will train construction crews on the sensitive wildlife resources and exclusion zones within the proposed construction alignment.

Mitigation Measure W-6: Use Trenchless Construction Techniques for Special-Status Wildlife Species Protection

An SCWA or sanitation district contractor will use impact avoidance or reduction measures such as jack-and-bore or other trenchless techniques to reduce the need for surface construction within identified sensitive locales, and the reconfiguration, limitation, or other control of areas proposed to be graded.

Mitigation Measure W-7: Restore Habitat Modified by Construction

An SCWA or sanitation district contractor will restore habitat to preconstruction conditions in consultation with USFWS and DFG and will provide on-site mitigation of modifications to sensitive species habitat, if necessary. Exact mitigation will be determined through consultation with USFWS or DFG.

Water Delivery Project Component (Napa Pipeline)

The Napa Pipeline would have the potential for impacts on several special-status species and/or their habitat as Segment 1 of the pipeline is constructed through the Stanly Ranch. Table 6-4 lists the special-status species potentially affected by the Napa Pipeline. Impacts would occur only during construction and would be temporary in nature. Impacts may include disturbance from project noise, harassment from construction activity and the presence of humans and equipment, and temporary modification of habitat during construction. Construction activities could also cause direct mortality of ground-dwelling special-status species by inadvertently striking them with construction equipment. This impact is considered significant. Implementation of Mitigation

Measures W-4 through W-7 would reduce this impact to a less-than-significant level.

Table 6-4. Napa Pipeline Potentially Affected Species

Species *Scientific Name*	Potential Location	Potential Impact	Mitigation Measures
Salt marsh harvest mouse *Reithrodontomys raviventrus halicoetes*	Pickleweed habitat on the Stanly Ranch	Noise disturbance, construction activity harassment, temporary modification of habitat, direct mortality	W-4, W-5, W-6, and W-7
California horned lark *Eremophila alpestris*	Abandoned railroad bed on the Stanly Ranch	Noise disturbance, construction activity harassment, and temporary modification of habitat	W-4, W-5, W-6, and W-7
Salt marsh common yellowthroat *Geothlypis trichas sinuosa*	Brackish marsh on the Stanly Ranch	Noise disturbance, construction activity harassment, and temporary modification of habitat	W-4, W-5, W-6, and W-7
Tricolored blackbird *Agelaius tricolor*	Wetlands on the Stanly Ranch	Noise disturbance, construction activity harassment, and temporary modification of habitat	W-4, W-5, W-6, and W-7
San Pablo song sparrow *Melospiza melodia samuelis*	Pickleweed habitat on the Stanly Ranch	Noise disturbance, construction activity harassment, and temporary modification of habitat	W-4, W-5, W-6, and W-7

Water Delivery Project Component (CAC Pipeline)

The new portion of the CAC Pipeline would be constructed within Green Island Road. The pipeline would cross the Napa River using existing pipelines. The pipeline would not pass through special-status species habitat. Therefore, the potential for impacts on special-status species is less than significant.

Water Delivery Program Component

The exact alignments and construction methods for the Water Delivery Program Component pipelines have not yet been determined. However, the potential future pipelines from the LGVSD, Novato SD, and City of Petaluma WWTPs are anticipated to parallel roadways, railroads, and eventually turn east across the Wingo and Ringstrom Bay Units of the NSMWA. These potential future pipelines have the potential to affect special-status species listed in Table 6-2. Impacts on these species would occur only during construction and would be temporary. Impacts may include disturbance from project noise, harassment from construction activity and the presence of humans and equipment, and temporary modification of habitat during construction. Construction activities could also cause direct mortality of ground-dwelling special-status species by inadvertently striking them with construction equipment.

This impact is considered significant. Implementation of Mitigation Measure W-4, "Complete Focused Surveys for Special-Status Wildlife Species before Construction," would reduce this impact to a less-than-significant level. This measure is described under "Water Delivery Project Component (Sonoma

Pipeline)" above. The results of these surveys may also require implementation of Mitigation Measures W-5, W-6, and W-7.

6.2.6.2 Impact W-6: Interference with the Movement of Wildlife

Water Delivery Project Component

Impacts on wildlife from constructing the Sonoma, Napa and CAC pipelines would be short-term and would occur only during the construction phase of the project. Because the pipeline would be buried, it would not act as a barrier to wildlife movement or migration once construction is complete. In addition, the pipelines would be constructed primarily within existing road and railroad ROWs, reducing any direct loss of habitat.

Construction of each pipeline is estimated to be completed within 1 year and would include activity in 200- to 300-foot stretches for approximately 5 days. Construction is not expected to adversely affect wildlife movement because construction would be completed quickly and only a limited amount of area (200–300 linear feet) would be disturbed at any time. Because construction would be limited, wildlife is expected to be able to safely move around the temporary construction site. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the potential future pipelines have not yet been determined. Impacts on migratory wildlife and wildlife corridors would occur only during construction and would be temporary. Because of construction activity, migrating wildlife would be required to divert around the construction area if possible; if diversion is not possible, migration would be affected. Wildlife corridors may be affected by any temporary losses of habitat resulting from construction. Use of nursery sites by wildlife for rearing young may be affected by harassment caused by noise and construction activity.

This impact is considered significant. Implementation of Mitigation Measure W-4, "Complete Focused Surveys for Special-Status Species before Construction," would reduce this impact to a less-than-significant level. This measure is described under Impact W-3 above.

6.2.7 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 are more extensive than those under Salinity Reduction Option 1A for Impacts W-3, W-4, and W-5 because of additional construction. Impacts unique to this option are described below.

6.2.7.1 Beneficial Impact W-7: Increase in Mudflat Foraging Habitat

Mudflats and shallow water are important foraging and resting habitat areas for shorebirds and dabbling waterfowl that migrate through and winter in the San Pablo Bay area. Breaching the outboard levees and introducing tidal flow to the selected ponds in the Napa River Unit would increase the area of tidal mudflat both around the edges of ponds and along channels in the project area. Tidal mudflats support benthic organisms that are prey for shorebirds. Currently there are approximately 80 acres of intertidal mudflat in the sloughs within the project area (Table 2-2). The acreage of intertidal mudflat is expected to increase to 2,490 acres by year 10. As middle marsh and lower marsh become established, the acreage of intertidal mudflat is expected to stabilize at 2,670 acres. This represents an increase of 2,420 acres from existing conditions. By year 50, intertidal mudflats would be limited primarily to slough channels and the margins of subtidal channels. The increase in mudflat areas is considered beneficial to shorebirds and other water birds. This impact is considered beneficial. No mitigation is required.

6.2.7.2 Beneficial Impact W-8: Long-Term Increase in Subtidal Habitat

Subtidal aquatic habitat is expected to increase under Habitat Restoration Option 1. As sediment deposition occurs, the open-water habitat created initially by breaching the levees would decrease. Currently, there are approximately 430 acres of subtidal habitat within the project area (Table 2-2). The acreage of subtidal habitat is expected to increase to 760 acres by year 10 of the project and then stabilize at 770 acres by year 50. This represents an increase of 430 acres from current conditions by year 50. Stable vegetated~~ion~~ channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat for a variety of estuarine and marine fish species that would provide food for various marsh-associated piscivorous birds including egrets, herons, and grebes. The increase in aquatic habitat would benefit the fish, birds, and waterfowl dependent on this habitat. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.7.3 Beneficial Impact W-9: Increase in Lower Marsh and Middle Marsh Habitats

Restoration of the tidal marshes in the Napa River Unit would result in a substantial increase in lower marsh and middle marsh habitats. These habitats support endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh harvest mouse, Suisun ornate shrew, northern harrier, saltmarsh common yellowthroat, and San Pablo song sparrow. Currently there are approximately 30 acres of lower marsh and 1,210 acres of middle marsh habitat within the project area. These habitats are located along existing sloughs and in Pond 2A and are generally of low quality (Wilcox pers. comm.). The acreage of lower marsh is expected to increase to 300 acres by year 10 and then stabilize at 90 acres by year 50. This represents an increase of 60 acres of lower marsh habitat by year 50. Similarly, the acreage of middle marsh habitat is expected to increase to 2,180 acres by year 50 after declining by approximately 100 acres during the first 20 years of restoration. This represents an increase of 970 acres from current conditions by year 50. This impact is considered beneficial. No mitigation is required.

6.2.7.4 Beneficial Impact W-10: Lowering of Levees to Create Marsh Habitat

Construction of this habitat restoration option would result in the lowering of 22,200 feet of upland levee area to elevations consistent with marsh habitat. This represents roughly 10% of all levees in the project area and roughly 20% of the levees surrounding the ponds that would be restored to tidal marsh in this option. Levee upland areas provide some roosting, foraging, and refuge areas for wildlife but are of overall low quality (Wyckoff pers. comm.). Levees are typically covered with vegetation such as iceplant or weedy annuals that offer inferior high-tide cover for marsh wildlife (Baye pers. comm.). There would be a short-term loss in the function and value of the upland levees that would be replaced with middle and upper marsh habitat that is of higher quality for most marsh species. In areas graded to elevations consistent with upper marsh vegetation, gumplant *(Grindelia stricta)* will typically establish juveniles the first year and grow to full flowering height the second year after seed. Gumplant provides superior high-tide refugia for marsh wildlife, particularly rail species (Baye pers. comm.). Upper marsh vegetation will also provide shrub-nesting opportunities.

Levees can also provide access and habitat for predators (e.g., red fox and feral cats) that compromise the ecological objectives of restoration and are a threat to the local existence of endangered species and other marsh wildlife. Levees can also act as barriers to species migration by creating discontinuous habitat. Lowering of levees to marsh elevations in conjunction with breaches will inhibit access and reduce habitat for predators and will connect existing fringe marsh with the interior of the ponds being restored to tidal habitats, increasing opportunities for the movement of wildlife between these areas. This impact is considered beneficial. No mitigation is required.

Levee lowering would be conducted in areas adjacent to wide areas of existing fringe marsh habitat in order to provide upper marsh refugia, and/or in areas with small areas of fringe marsh habitat that would be subject to erosion as a result of the increased tidal prism in order to preserve species corridors. Exact locations of levee lowering would be determined during final design, in consultation with the resource agencies, in order to best serve marsh species. Levees c~~w~~ould be pushed inward toward the ponds and borrow ditches rather than outward toward existing higher quality habitat. Levee grading would result in additional construction-related disturbance to or mortality of special-status species. Impacts on special-status species associated with ground disturbance are described in Impacts W-3, W-4, and W-5.

6.2.7.5 Impact W-11: Exposure of Wildlife to Contaminants in Sediments and Waters from San Pablo Bay and the Napa River

Restoration would entail reestablishment of substantial tidal connectivity to Ponds 3, 4/5, and possibly 6/6A at some future date. Reestablishing substantial tidal connectivity to these ponds would result in hydrologic exchange between restored marshlands and waters of San Pablo Bay and the Napa River, possibly resulting in the deposition of contaminant-laden sediments. As discussed in Chapter 4, "Water Quality," reestablishing tidal exchange is expected to cause the quality of water and sediments within the ponds to become closer to the quality of water in San Pablo Bay and the Napa River. The levels of some constituents are expected to increase. Conversely, the levels of other constituents are expected to decrease. Contaminants may have an adverse effect on biological resources, including reduction in reproductive success at multiple levels of the ecosystem, immune system effects, and overall reduced population viability. Appendix C, "Contaminants Toxic to Wildlife," includes information on the contaminants and associated biological effects.

Contaminants are found in the waters and sediments of the salt ponds, San Pablo Bay, and the Napa River. As indicated in Tables 4-5 and 4-6, some of these contaminants exceed sediment quality criteria established by NOAA and the water quality criteria established by the SWRCB (CTR). For example, the waters of the Napa River and San Pablo Bay exceed CTR water quality criteria for copper, mercury, nickel and total PAHs. In addition, sediments exceed the ER-L values for copper, mercury, nickel, arsenic, chromium, and DDT, but not the ER-M values for any constituent. The level these constituents would need to reach in combination with the duration of exposure to result in a substantial effect on wildlife abundance is not known. However, levels are not expected to be substantially different than what is currently occurring within the sloughs and channels outside of the ponds.

As discussed in Section 2.7.3.2, "Wildlife Monitoring in Managed Ponds and Restored Tidal Habitat," USGS would continue to monitor conditions at the project site. At a minimum, monitoring would occur during the salinity reduction phase of the project and for 10 years after each pond is breached. This

information would be used to compare preproject and postproject conditions and to identify changes in the condition of biological resources. In addition, as discussed in Section 2.7~~6~~.4, "Adaptive Management," the project sponsors would implement an adaptive management plan. This plan would establish quantitative standards for the project. The combination of wildlife monitoring and adaptive management would ensure that adverse effects on wildlife are identified and addressed as the tidal marsh is restored. This impact is considered less than significant. No mitigation is required.

6.2.7.6 Impact W-12: Loss of Open-Water Habitat

Implementation of Habitat Restoration Option 1 would result in the loss of open-water habitat provided by managed ponds when the levees surrounding Ponds 3, 4, and 5 are breached. This action would result in the loss of existing saline open-water habitat historically used by a variety of shorebirds, waterfowl, and other waterbirds, such as grebes and phalaropes, prior to the increases of salinity within the ponds. Ponds 3, 4, and 5 provided high-quality waterfowl foraging and refuge habitat during salt production and since DFG took ownership of the property in 1994; however, these habitat values have declined over the last ~~1–2~~ several years because of dramatically increasing salinities, which have resulted from an inability to take adequate water into Ponds 3, 4, and 5 and the lack of a discharge point within the pond system.

Currently, there are approximately 6,460 acres of open-water habitat within the project area, although not all pond areas are currently suitable habitat. The amount of open-water habitat is expected to decrease to `3,550 acres by year 10 of the project, a decrease of 2,910 acres from existing conditions. If Ponds 6 and 6A are also restored to tidal marsh after 10–20 years, there would be an additional loss of 1,146 acres of open-water habitat, bringing the total amount to 2,404 acres by year 50. The loss of this open-water pond habitat is expected to be offset by the increase in mudflat and subtidal habitat, the increased productivity and habitat values of the restored ponds, and by salinity reduction and improved management of Ponds 6, 6A, 7A, 8, and ultimately 7 ~~and 8~~. Ponds 1, 1A, and 2 would continue to be managed as ponds to benefit migratory shorebirds and waterfowl.

The project sponsors, in coordination with USGS, would conduct 10 years of monitoring after restoration of Ponds 3, 4, and 5 in order to evaluate the changes in ecological values and productivity and develop adaptive management approaches as needed, such as maintaining Ponds 6 and 6A as managed ponds. Therefore, the direct impact on waterfowl and shorebirds is considered less than significant. No mitigation is required. The long-term regional effect of current and planned habitat restoration projects on waterfowl habitat is described in Chapter 18, "Cumulative Impacts and Other Required Analyses."

6.2.8 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 are more extensive than those under Salinity Reduction Option 1A for Impacts W-3, W-4, and W-5 because of additional construction, and nearly the same as that under Habitat Restoration Option 1 for Impact W-11. Beneficial Impacts W-7, W-8, W-9, and W-10 and Impacts W-12 and W-13 are slightly different and are described below.

6.2.8.1 Beneficial Impact W-7: Increase in Mudflat Foraging Habitat

Under this option, the acreage of intertidal mudflat is expected to increase to 3,840 acres by year 10 and to stabilize at 2,800 acres by year 50. This represents an increase of 2,720 acres from current conditions. Mudflats serve as foraging habitat for shorebirds and other waterbird species. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.8.2 Beneficial Impact W-8: Long-Term Increase in Subtidal Habitat

Subtidal aquatic habitat is expected to increase under Habitat Restoration Option 2. As sediment deposition occurs, the open-water habitat created initially by breaching the levees would decrease. Currently, there are approximately 430 acres of subtidal habitat within the project area (Table 2-2). The acreage of subtidal habitat is expected to increase to 920 acres by year 10 of the project and to stabilize at 930 acres by year 50. This represents an increase of 500 acres from current conditions. Stable vegetation channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat for a variety of estuarine and marine fish species that would provide food for various marsh-associated piscivorous birds including egrets, herons, and grebes. The increase in aquatic habitat would benefit the fish, birds, and waterfowl dependent on this habitat. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.8.3 Beneficial Impact W-9: Increase in Lower Marsh and Middle Marsh Habitats

Under this option, by year 50 the acreages of lower marsh habitat and middle marsh habitat are expected to increase to 230 and 2,180 acres, respectively. The increase in the amount of lower marsh and middle marsh habitats would substantially increase suitable habitat for California clapper rail, California black rail, salt marsh harvest mouse, Suisun ornate shrew, northern harrier, saltmarsh

common yellowthroat, and San Pablo song sparrow in the project area. This impact is considered beneficial. No mitigation is required.

6.2.8.4 Beneficial Impact W-10: Lowering of Levees to Create Marsh Habitat

Construction of this habitat restoration option would result in the lowering of 34,600 feet of upland levee area to elevations consistent with marsh habitat. This represents roughly 15% of all levees in the project area and roughly 20% of the levees surrounding the ponds that would be restored to tidal marsh in this option. Overall, these effects would be positive for marsh wildlife, as described in Habitat Restoration Option 1. Therefore, this impact is considered beneficial. No mitigation is required.

Levee grading would result in additional construction-related disturbance or mortality to special-status species. Impacts on special-status species associated with ground disturbance are described in Impacts W-3, W-4, and W-5.

6.2.8.5 Impact W-12: Loss of Open-Water Habitat

Under this option, the acreage of open-water habitat provided by managed ponds would be 2,080 acres. This represents a decrease of 4,380 acres from current conditions. Option 2 would result in a greater loss of saline open-water habitat used by shorebirds and other waterbirds than would Habitat Restoration Options 1, 3, or 4. The loss of this habitat would be generally offset by the creation of new mudflat and subtidal habitat and by salinity reduction and management of other ponds in the project area. Therefore, this impact is considered less than significant. No mitigation is required.

6.2.9 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 are more extensive than those under Salinity Reduction Option 1A for Impacts W-3, W-4, and W-5 because of additional construction and nearly the same as that under Habitat Restoration Option 1 for Impact W-11. Beneficial Impacts W-7, W-8, W-9, and W-10 and Impacts W-12 and W-13 are slightly different and are described below.

6.2.9.1 Beneficial Impact W-7: Increase in Mudflat Foraging Habitat

Under this option, the acreage of intertidal mudflat is expected to increase to 1,790 acres by year 10 and to stabilize at 930 acres by year 50. This represents an increase of 850 acres from current conditions. Mudflats serve as foraging

habitat for shorebirds and other waterbird species. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.9.2 Beneficial Impact W-8: Increase in Subtidal Habitat

Subtidal aquatic habitat is expected to increase under Habitat Restoration Option 3. As sediment deposition occurs, the open-water habitat created initially by breaching the levees would decrease. Currently, there are approximately 430 acres of subtidal habitat within the project area (Table 2-2). The acreage of subtidal habitat is expected to increase to stabilize at 680 acres by year 10 of the project. This represents an increase of 250 acres from current conditions. Stable vegetation channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat for a variety of estuarine and marine fish species that would provide food for various marsh-associated piscivorous birds including egrets, herons, and grebes. The increase in aquatic habitat would benefit the fish, birds, and waterfowl dependent on this habitat. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.9.3 Beneficial Impact W-9: Long-Term Increase in Lower Marsh and Middle Marsh Habitats

Under this option, by year 50 the amounts of lower marsh habitat and middle marsh habitat are expected to increase to 80 and 1,010 acres, respectively. The increase in the amounts of lower marsh and middle marsh habitats would substantially increase suitable habitat for California clapper rail, California black rail, salt marsh harvest mouse, Suisun ornate shrew, northern harrier, saltmarsh common yellowthroat, and San Pablo song sparrow in the project area. This impact is considered beneficial. No mitigation is required.

6.2.9.4 Beneficial Impact W-10: Lowering of Levees to Create Marsh Habitat

Construction of this habitat restoration option would result in the lowering of 14,600 feet of upland levee area to elevations consistent with marsh habitat. This represents roughly 5% of all levees in the project area and roughly 20% of the levees surrounding the ponds that would be restored to tidal marsh in this option. Overall, these effects would be positive for marsh wildlife, as described in Habitat Restoration Option 1. Therefore, this impact is considered beneficial. No mitigation is required.

Levee grading would result in additional construction-related disturbance of or mortality to special-status species. Impacts on special-status species associated with ground disturbance are described in Impacts W-3, W-4, and W-5.

6.2.9.5 Impact W-12: Loss of Open-Water Habitat

Under this option, the acreage of open-water habitat provided by managed ponds would be 4,290 acres. This represents a decrease of 2,170 acres from current conditions. Habitat Restoration Option 3 would result in a lesser loss of saline open-water habitat used by shorebirds and other waterbirds than would Habitat Restoration Options 1, 2, or 4. The loss of this habitat would be generally offset by the creation of new mudflat and subtidal habitat and by salinity reduction and management of other ponds in the project area. Therefore, this impact is considered less than significant. No mitigation is required.

6.2.10 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 are more extensive than those under Salinity Reduction Option 1A for Impacts W-3, W-4, and W-5 because of additional construction and nearly the same as that under Habitat Restoration Option 1 for Impact W-11. Beneficial Impacts W-7, W-8, W-9, and W-10 and Impacts W-12 and W-13 are slightly different and are described below.

6.2.10.1 Beneficial Impact W-7: Increase in Mudflat Foraging Habitat

Under this option, the acreage of intertidal mudflat is expected to increase to 2,210 acres by year 10 and to stabilize at 900 acres by year 50. This represents an increase of 820 acres from current conditions. Mudflats serve as foraging habitat for shorebirds and other waterbird species. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.10.2 Beneficial Impact W-8: Long-Term Increase in Subtidal Habitat

Currently, there are approximately 430 acres of subtidal habitat within the project area (Table 2-2). The acreage of subtidal habitat is expected to increase to increase to 760 acres by year 10 and stabilize at 770 acres by year 50. This represents an increase of 340 acres from current conditions. Stable vegetation channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat for a variety of estuarine and marine fish species that would provide food for various marsh-associated piscivorous birds including egrets, herons, and grebes. The increase in aquatic habitat would benefit the fish, birds, and waterfowl dependent on this habitat. Therefore, this impact is considered beneficial. No mitigation is required.

6.2.10.3 Beneficial Impact W-9: Increase in Lower Marsh and Middle Marsh Habitats

Under this option, by year 50 the amounts of lower marsh habitat and middle marsh habitat are expected to increase to 640 and 2,360 acres, respectively. The increase in the amount of lower marsh and middle marsh habitats would substantially increase suitable habitat for California clapper rail, California black rail, salt marsh harvest mouse, Suisun ornate shrew, northern harrier, saltmarsh common yellowthroat, and San Pablo song sparrow in the project area. This impact is considered beneficial. No mitigation is required.

6.2.10.4 Beneficial Impact W-10: Lowering of Levees to Create Marsh Habitat

Construction of this habitat restoration option would result in the lowering of 22,200 feet of upland levee area to elevations consistent with marsh habitat. This represents roughly 10% of all levees in the project area and roughly 20% of the levees surrounding the ponds that would be restored to tidal marsh in this option. Overall, these effects would be positive for marsh wildlife, as described in Habitat Restoration Option 1. Therefore, this impact is considered beneficial. No mitigation is required.

Levee grading could result in additional construction-related disturbance of or mortality of special-status species. Impacts on special-status species associated with ground disturbance are described in Impacts W-3, W-4, and W-5.

6.2.10.5 Impact W-12: Loss of Open-Water Habitat

Under this option, the acreage of open-water habitat provided by managed ponds would be 3,550 acres. This represents a decrease of 2,910 acres from current conditions. Habitat Restoration Option 4 would result in the same loss of saline open-water habitat used by shorebirds and other waterbirds as Habitat Restoration Option 1. The loss of this habitat would be generally offset by the creation of new mudflat and subtidal habitat and by salinity reduction and management of other ponds in the project area. Therefore, this impact is considered less than significant. No mitigation is required.

Chapter 7
Biological Resources—Aquatic Resources

7.1 Environmental Setting

7.1.1 Introduction and Sources of Information

This chapter describes the fish and aquatic invertebrates in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information on existing conditions is derived from other environmental documents prepared for the project area and vicinity, including the following:

- *Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements for Key Plants, Fish, and Wildlife* (Goals Project 2000);
- Baseline Monitoring of the Pond 2A Tidal Restoration Project (MEC Analytical Systems 2000);
- Napa Salt Ponds Biological Resources (Lewis Environmental Services, Inc., and Wetlands Research Associates, Inc. 1992);
- The Natural Resources of Napa Marsh, Coastal Wetland Series #19 (Madrone Associates 1977);
- Status and Trends Report on Wildlife of the San Francisco Estuary (U.S. Fish and Wildlife Service 1992);
- Species List for the Napa River Salt Pond Restoration Project, Napa and Solano Counties, California (U.S. Fish and Wildlife Service 2001);
- State of the Estuary (Association of Bay Area Governments 1992);
- Huichica Creek Watershed: Natural Resources Protection and Enhancement Plan (Napa County Resource Conservation District 1993); and
- *Draft Subsequent Environmental Impact Report, March 1986, Wastewater Reclamation and Disposal Facilities* (Landon, Wheeler, and Weinstein 1986).
- *Stanly Ranch Specific Plan Draft EIR* (Brady/LSA, August 1998).

- *Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration* (Napa Sanitation District, January 11, 1995).

The abundance and distribution of fish species were analyzed from long-term monitoring data collected by DFG at sampling stations in the Bay-Delta estuary. Survey data from midwater trawl, otter trawl, and beach seine catches were used to represent the range of habitats used by species. Information on fish use of tidal marsh habitats was based largely on review of DFG data and discussion with DFG fisheries biologist Kathryn Heib.

Information on species ecology and life history was derived from interpretation of survey data and review of species profiles prepared for the *Baylands Ecosystem Species and Community Profiles* report (Goals Project 2000).

Other studies of value providing species abundance and distribution include the *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds, San Francisco Bay Estuary* (Takekawa et al. 2000).

7.1.2 Regulatory Setting

Several federal and state agencies have regulatory authority or responsibility over project-related activities that affect aquatic resources. The National Marine Fisheries Service biological opinion has been issued and has resulted in a letter of no effect. Table 7-1 summarizes project-related activities, the type of resource affected, and the government agency with regulatory authority over the activity.

7.1.2.1 Federal

The regulatory setting for aquatic resources under ESA and CWA Section 401 is nearly the same as that described in Chapter 4, "Water Quality" (CWA Section 401), and Chapter 5, "Biological Resources—Vegetation" (ESA). The following regulatory requirements also apply for aquatic resources.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act establishes a management system for national marine and estuarine fishery resources. This legislation requires all federal agencies to consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect essential fish habitat (EFH). EFH is defined as waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The legislation states that migratory routes to and from anadromous fish spawning grounds also should be considered EFH. The phrase adversely affect refers to the creation of any impact that reduces the quality or quantity of EFH. Federal activities that occur outside an EFH but that may nonetheless have an impact on EFH waters and substrate also must be considered in the consultation process. Under the Magnuson-Stevens

Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must be considered as well.

The Magnuson-Stevens Act states that consultation regarding EFH should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes, such as NEPA, the FWCA, the CWA, and ESA. EFH consultation requirements can be satisfied through concurrent environmental compliance requirements if the lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for EFH assessments. The ESA compliance discussed above would also address the expected project effects on commercially important fish and EFH. NMFS would provide EFH conservation recommendations. With implementation of the EFH conservation recommendations, NMFS~~USFWS~~ is likely to conclude that significant improvement to the EFH of commercially important fish would occur as a result of the Napa River Salt Marsh Restoration Project.

7.1.2.2 State

The regulatory setting for aquatic resources under CESA and California Fish and Game Code Section 1600 *et seq.* is nearly the same as that described in Chapter 5, "Biological Resources—Vegetation."

Table 7-1. Summary of Regulatory Setting for Aquatic Resources

Project-Related Activity	Regulatory Authority
Construction activities that could adversely affect water quality	RWQCB, permitting authority under Section 401 of the CWA
Alteration of stream channel, bed, or bank, including dredging or discharge of fill	DFG, permitting authority under Section 1601 (Lake or Streambed Alteration Agreement) of the California Fish and Game Code
Effects on species or the habitat of species listed or candidates for listing under ESA	USFWS and NMFS, formal consultation and permitting authority under Section 7 of ESA
Effects on species or the habitat of species listed or candidates for listing under CESA	DFG, consultation and permitting authority under Section 2081 of CESA
Effects on other special-status species, including species of concern and CNPS-listed plants	DFG and USFWS, responsible agencies to review EIR and EIS
Effects on species or the habitat of commercially viable fish	NMFS consultation under Essential Fish Habitat

7.1.2.3 Special-Status Fish Species

Special-status fish species are legally protected under CESA and ESA or other regulations and are considered sufficiently rare by the scientific community to qualify for such listing. For the purpose of this report, the term *special-status fish* refers to species that

- are listed or proposed for listing as threatened or endangered under ESA (50 CFR 17.11 [listed animals] and various notices in the *Federal Register* [proposed species]);
- are candidates for possible future listing as threatened or endangered under ESA (61 FR 40:7596–7613, February 28, 1996);
- are species of concern to USFWS and NMFS;
- meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- are listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5); or
- are fully protected in California (California Fish and Game Code, Section 5515).

7.1.3 Regional Setting

7.1.3.1 Fish

Fish species found in estuaries are of five broad types: nondependent marine, dependent marine, true estuarine, diadromous, and freshwater (Moyle and Cech 1982).

Nondependent marine fishes are those species, commonly found near the oceanic mouth of the estuary, that are not dependent on the estuary to complete their life cycles. Examples of such species in San Pablo Bay are shiner perch (*Cymatogaster aggregata*) and starry flounder (*Platichthys stellatus*).

Dependent marine species need the estuary to complete at least one of their life stages. This need can be for spawning, for rearing of young, or for feeding grounds for adults. An example of a dependent marine species is Pacific herring (*Clupea harengus*), which uses San Pablo Bay for spawning and rearing its young.

True estuarine species complete their entire life cycles in the estuary. In the Bay-Delta estuary, delta smelt (*Hypomesus transpacificus*) and longfin smelt (*Spirinichus thaleichthys*) are estuarine species.

Diadromous fishes are those that migrate through estuaries on their way either to fresh water or to saltwater. There are two types: anadromous species that

migrate from saltwater to spawn in fresh water and catadromous species that migrate from fresh water to spawn in the ocean. Young of both types may spend considerable time in estuaries, taking advantage of abundant food (Moyle 2002). The most common anadromous species in San Pablo Bay grow to maturity in the ocean and spawn in fresh water. Examples are chinook salmon, steelhead, and striped bass (*Morone saxatilis*). There are no catadromous species.

Freshwater species are those that complete their entire life cycles in the upper, tidally influenced reaches of the estuary. An important example is splittail (*Pogonichthys macrolepidotus*), although splittail are tolerant of estuarine salinity.

The presence, abundance, and distribution of fish species in the Bay-Delta estuary are determined by numerous abiotic and biological factors (Moyle and Cech 1982). However, there are some general factors that exert a strong influence and explain much of the spatial and temporal variability in species abundance and distribution. In particular, physical and chemical factors such as temperature, salinity, and oxygen levels play important roles in determining the seasonal timing and spatial distribution of fish use.

Most of the species that use the estuary do so on a seasonal basis, taking advantage of favorable conditions to complete their life cycles. The fluctuating and intermediate salinity typical of estuarine habitats is the factor that limits the penetration of both marine and freshwater species into the mixed waters in the interior of the estuary. Accordingly, the specific area of San Pablo Bay in which a species is found is determined largely by the species' salinity tolerances. San Pablo Bay contains a productive and diverse fish community. The considerable inflow of the Sacramento–San Joaquin River system into San Pablo Bay provides a rich source of nutrients to support organic production. In addition, nutrient and organic input from the Napa River, Sonoma Creek, and the Petaluma River further enhances the region's ecological productivity. The freshwater input of all these river systems creates the large spatial and temporal variations in salinity and temperature that characterize San Pablo Bay.

Species Types and Abundance

DFG conducts annual fish surveys in San Pablo Bay. The results of the catches from these surveys are described below. The 15 most abundant fish species in order of decreasing total catch in the Bay-Delta estuary surveys over the last 21 years were

- northern anchovy (*Engraulis mordax*),
- longfin smelt,
- Pacific herring,
- white croaker (*Genyonemus lineatus*),
- English sole (*Parophrys vetulus*),

- yellowfin goby (*Acanthogobius flavimanus*),
- Pacific staghorn sculpin (*Leptocottus armatus armatus*),
- striped bass,
- Bay goby (*Lepidogobius lepidus*),
- jacksmelt,
- plainfin midshipman (*Porichtus notatus*),
- shiner perch,
- speckled sanddab (*Citharichthys stigmaeus*),
- starry flounder, and
- topsmelt (Atherinops affinis).

These species accounted for 98.9% of the total catch. Northern anchovy, the most abundant fish in north San Francisco and San Pablo Bays, accounted for 73.2% of the total catch. The other fish species in this category ranged from 8.4% to less than 0.4% of the total catch. The distribution of species by abundance, therefore, is far from uniform. Rather, a few relatively abundant species comprise the majority of the catch. (California Department of Fish and Game 1999.)

Sixteen species were caught by DFG over the last 21 years at a moderate level. These were, in order of decreasing total catch,

- arrow goby (*Clevelandia ios*),
- chinook salmon,
- American shad (*Alosa sapidissima*),
- threespine stickleback (*Gasterosteus aculeatus*),
- brown smoothhound (*Mustelus henlei*),
- dwarf surfperch (*Micrometrus minimus*),
- cheekspot goby (*Ilypnus gilberti*),
- surf smelt (*Hypomesus pretiosus*),
- Bay pipefish (*Sygnathus leptorhynchus*),
- walleye surfperch (*Stizostedion vitreum*),
- inland silverside,
- threadfin shad (*Dorosoma petenense*),
- delta smelt,
- brown rockfish,
- California halibut (*Paralichthys californicus*), and
- California tonguefish (Symphurus atricauda).

The abundant and moderately abundant species collectively accounted for 99.8% of the total catch from 1980 to 1995. That is, roughly 31 species accounted for almost all of the total catch in the north San Francisco and San Pablo Bays. (California Department of Fish and Game 1999.)

The remaining species can be considered relatively rare in the catch. Some of these (e.g., splittail) are special-status species and are addressed accordingly. Many of the other infrequently caught species are occasional marine species that generally have low and variable abundance in the estuary. Others (e.g., hitch [*Lavinia exilicauda*]) are freshwater species swept into the estuary during high flow events.

Northern anchovy was most frequently caught in the DFG surveys, followed by longfin smelt, English sole, white croaker, and Bay goby. In general, northern anchovy and longfin smelt are the two most abundant species in north San Francisco and San Pablo Bays and occur throughout the water column as they feed opportunistically. English sole is a flat fish that is typically found on the bottom; Bay goby is also a demersal fish.

In shallow-water habitat, Pacific herring, northern anchovy, yellowfin goby, jacksmelt, Pacific staghorn sculpin, and topsmelt each contributed more than 5% to the total beach seine catch.

Tidal marshes provide habitat for residents, partial residents, tidal visitors (or tidal transients), and seasonal visitors (or seasonal transients). Residents are those species (e.g., killifish) that complete their entire life cycles in the marsh. Partial residents (e.g., inland silverside [*Menida beryllina*]) are found in the marsh as juveniles throughout the year. Tidal visitors are typically larger fishes (e.g., jacksmelt [*Atherinopsis californiensis*], and flounders) that move into the marsh at high tide to feed on the abundant juvenile fish and invertebrates. Seasonal visitors are species that use the tidal marsh as spawning or nursery areas (e.g., sticklebacks) or as seasonal refuges from predators (e.g., chinook salmon [*Oncorhynchus tshawytscha*]).

The broad range of environmental conditions in tidal marsh leads to highly variable species composition and abundance. Single-event sampling can yield low species numbers (e.g., six species at Napa River Salt Marsh Pond 2A), whereas species occurrence over a year or several years can be quite high (e.g., 63 species reported at Bair Island marshes). Large fluctuations in species composition and numbers, as well as biomass, are typical of coastal wetland systems (Moyle and Cech 1982, Williams and Desmond 2001). Variability is caused not only by seasonal and tidal movements of fishes but also by differing responses of fishes to environmental stressors (e.g., salinity, temperature, abundance of prey, and predators). The spatial and temporal dynamics contribute to the importance of fish in the transport of nutrients and energy across habitats at multiple trophic levels in the estuarine foodweb (Allen 1982, Kneib 1997, Kwak and Zedler 1997, Williams and Desmond 2001).

The ecological benefits that vegetated tidal marsh offers to assemblages of fish species have been well documented (Kneib 1997). Fish migrate with the tides

onto the marsh surface to feed and frequently exhibit a fuller gut at high or ebbing tides than at other times (Harrington and Harrington 1961, McIvor and Odum 1988, Rozas and LaSalle 1990, Rountree and Able 1992, Kneib 1997). A bioenergetics model of killifish has indicated that sporadic foraging on marsh surfaces, in conjunction with tidal cycles, enhances growth (Madon 2001). Marsh vegetation is known to provide cover from predators for transient and resident fish species (Ryer 1988). Moreover, several transient visitors (mostly species from the silverside family Atherinidae, such as topsmelt) and resident species (e.g., killifish) spawn in marsh vegetation (Kneib 1997).

Open water areas adjacent to tidal marshes are important habitat for fishes such as white sturgeon (*Acipenser transmontanus*) and brown rockfish (*Sebastes auriculatus*) (Goals Project 1999). Deep water and channels also serve as migration corridors for anadromous fishes such as chinook salmon and steelhead (*Oncorhynchus mykiss*).

7.1.3.2 Aquatic Marine Invertebrates

Aquatic marine invertebrates occur in deep bay, tidal channel, and shallow subtidal and intertidal habitats. Most aquatic marine invertebrate communities throughout the Bay-Delta estuary are dominated by a relatively uniform composition of invasive nonnative species (Carlton 1979, URS 2001). However, estuarine habitats in north San Francisco and San Pablo Bays are less saline than those in south San Francisco Bay as a result of the considerable freshwater inflow from the Sacramento–San Joaquin River systems. Consequently, the estuarine invertebrates in north San Francisco and San Pablo Bays are generally more tolerant of, or rely on, brackish water.

Estuarine habitats support zooplanktonic and benthic invertebrates found throughout San Pablo Bay. Zooplankton are floating and free-swimming invertebrates that are suspended in the water column. They include such species assemblages as rotifers; cladocera; copepods; tunicates; larval forms of annelid worms, gastropods, and bivalves; and a plethora of crustaceans including Dungeness crab (*Cancer magister*). Zooplankton can be found throughout the water column in deep bay, channel, and shallow subtidal and intertidal habitats. Many of the zooplanktonic forms have larval or immature stages that, upon maturing, drop out of the water column to live in the benthos. Many benthic invertebrates are filter feeders (e.g., some polycheate worms, bivalves, and anemones) that rely upon both zooplankton and phytoplankton as food. Zooplankton are also ecologically important as a food resource for numerous other invertebrates and fish (e.g., anchovies, smelt).

A substantial decrease of native zooplankton in San Francisco Bay has been documented over the last 20 years (URS 2001). This decrease has resulted from loss of estuarine habitat and the introduction of invasive nonnative species that either compete with or feed on the native zooplankton. The introduced Asian clam (*Potamocorbula amurensis*) and two introduced Asian mysid shrimp have profoundly affected the zooplankton community and those native species dependent upon it (e.g., the native mysid shrimp *Neomysis mercedis*) by

competing with the zooplankton for phytoplankton or by feeding on the zooplankton directly (URS 2001).

Benthic invertebrates in their adult life stages are primarily associated with substrates and include sessile invertebrates, infauna, and epibenthos. Sessile invertebrates include sponges, anemones, hydroids, tubeworms, oysters, mussels, barnacles, and other species permanently or semipermanently attached to their substrates. These species are typically dependent on plankton for food and are, in turn, ecologically important as food resources for other invertebrates, fish, birds, and mammals.

Infauna are invertebrates that burrow or bore through mud, clay, or shale. Examples are polycheate and oligocheate worms, most bivalves, some gastropods, and some crustaceans. Some infaunal species filter plankton from the water, whereas others prey on other infauna. Most live within a few centimeters of the substrate surface.

Epibenthos are motile invertebrates that live on specific substrates. This group includes numerous gastropods, scallops, octopi, pycnogonids, some insects, starfish, sea urchins, and the vast majority of crustaceans, including crabs and shrimp. Most epibenthic invertebrates are herbivores or predators. Epibenthic invertebrates include Dungeness crab, rock crabs, and caridean shrimp. The muddy and sandy bottom in open water areas and major channels is important habitat for large invertebrates, including California bay shrimp, Dungeness crab, and rock crab.

A significant decrease in native benthic invertebrate fauna in San Francisco Bay has been documented over the last several decades (URS 2001). This decline has resulted primarily from habitat loss and the introduction of invasive nonnative species that either compete with or feed on the native benthic invertebrates. It is estimated that 40%–100% of the benthic invertebrate fauna in any area of the bay are nonnative species (Carlton 1979, URS 2001). Asian clam, green crab (*Carcinus maenas*), and Chinese mitten crab (*Eriocheir sinensis*) are invasive nonnative species of particular ecological concern that have become well established in the bay.

Along the intertidal mudflats and beaches, a variety of mites, springtails, flies, and beetles scavenge among flotsam along beach and estuary margins. Tiger beetles, many carabid beetles, and various fly species are active predators on these scavenging insects. Tiger beetle is a common insect predator, particularly on mudflats, tidal channel edges, and salt pans. Some crab species are amphibious, and scavenge or prey on other invertebrates on the mudflats, vegetated wetland margins, or rocky shoreline areas during low tides.

Invertebrate fauna important to the commercial fishery include *Cancer* crabs (primarily the Dungeness crab and rock crabs) and caridean shrimp. *Cancer* crabs and caridean shrimp are estuarine species that typically do not occur in deep water. These crustaceans are important scavengers and predators in the estuary and are also important as food for crabs, fish, birds, and mammals. Rock crabs and caridean shrimp support substantial fisheries in San Francisco Bay.

Dungeness crabs in the bay mature at nearly twice the rate of those in populations outside the bay, probably as a result of higher water temperatures. Early planktonic larval stages (zoea) typically are limited to the central bay, but later planktonic larval stages (megalops) are found throughout the bay. Immature nonplanktonic stages prefer the brackish water areas that occur throughout the estuary as far upstream as Suisun Bay (California Department of Fish and Game 1999). When Dungeness crabs approach breeding age, they migrate back to the central bay.

San Francisco Bay supports the largest Dungeness crab nursery in the world, but it is illegal to harvest Dungeness crab in the bay (California Department of Fish and Game 1999). Historically, the bay sustained an annual harvest of more than 9 million pounds of Dungeness crab. Since the 1960s, the harvest has decreased to between 2 and 3 million pounds annually, and the commercial fishery in the San Francisco region is now restricted exclusively to the coast outside the bay (California Department of Fish and Game 1999).

7.1.3.3 Aquatic Freshwater Invertebrates

Regional creeks and streams provide habitat for numerous macroinvertebrates, such as crustaceans, mollusks, annelids, and aquatic insects. Many aquatic insects spend their larval stage on the stream bottom. Representative macroinvertebrates include aquatic insects such as stoneflies, caddis flies, riffle beetles, mayflies, sow bugs, damselflies, dragonflies, and crane flies; crayfish; leeches; snails; and aquatic worms.

7.1.4 Project Setting

The Napa River Unit borders the northern edge of San Pablo Bay and includes estuarine reaches of the Napa and Sonoma Rivers. More than 15 fish species and 60 macroinvertebrate species use the habitats of the Napa River Unit. The land forms and the species in the project area are described below.

In addition to the aquatic habitats of the Napa River Unit, several other aquatic habitats are associated with the pipeline routes of the Water Delivery Option. As described in Chapter 2, "Site Description and Options," three pipelines are currently proposed and four potential future pipelines are being considered for this option, and several of them cross various streams and creeks. Table 7-2 summarizes the stream/creek crossings associated with each pipeline.

Table 7-2. Pipeline Stream/River Crossings

Pipeline	Unnamed Creeks (total number)	Named Creeks, Sloughs, and Rivers
Sonoma	5	Schell Slough, Huichica
Napa	2	Napa River, Suscol, Carneros
CAC	0	Napa River
Las Gallinas	0	Gallinas, Miller, Pacheco, Arroyo San Jose
Las Gallinas/Novato	0	Novato, Simonds Slough, Petaluma River
Petaluma	6	Wheat, Stage Gulch
Las Gallinas/Novato/Petaluma	2	Tolay, Sonoma, Steamboat Slough

Another aquatic resource consideration is the release of treated wastewater by the Project and Program Components of the Water Delivery Option into local creeks, sloughs, rivers, and San Pablo Bay during the wet season. SVCSD discharges treated wastewater into Schell Slough and Hudeman Slough during a winter discharge period of November 1 through April 30. Discharges to the sloughs are not permitted during the remainder of the dry season and the wastewater is used for reclamation on agricultural fields and wetlands, and also stored in large ponds. The normal discharge location is Schell Slough and averages about 3.5 mgd. For a short period at the beginning of each winter discharge period, the ponds are drained into Hudeman Slough. NSD is also permitted for winter-only discharges to the Napa River with an average flow rate of about 15 mgd; treated wastewater is reclaimed during the dry season. CAC discharges to North Slough and adjacent constructed wetlands.

7.1.4.1 Land Forms

Napa River Estuary

The Napa River estuary includes tidal channels and deep open water. The Napa River Unit borders approximately 5 miles of the Napa River estuary.

Salinity in the Napa River estuary varies from 0 ppt to 30~~22~~ ppt. Low salinity occurs during winter storms when large freshwater flows occur in the Napa and Sonoma Rivers, forcing higher salinity into downstream reaches. High flow from the Sacramento and San Joaquin Rivers may also reduce salinity by forcing the salinity gradient in the bay farther downstream. High salinity occurs during the summer when freshwater inflow is relatively low. Figure 4-1 in Chapter 4, "Water Quality," shows salinity variability at Point San Pablo and the San Mateo Bridge for each month.

Water in the Napa River is typically turbid and has a high level of suspended sediments (see Chapter 4, "Water Quality"). Sediments in the Napa River near the project are mostly muddy coarse sands, fine clays, and silts.

7.1.4.2 Species

Based on results from Takekawa et al. (2000), Ponds 1, 2, and 3 can sustain fish life, and Ponds 1, 2, 3, 4, and 7 can sustain invertebrate life. No surveys were conducted on Ponds 5, 6, 6A, 7A, and 8 as part of the Takekawa et al. (2000) studies. The surveys captured 16 fish species in Ponds 1, 2, and 3. Pacific staghorn sculpin, yellowfin goby, striped bass, and American shad were the dominant species captured in Pond 1. Much lower numbers of fish were present in Pond 2, and were primarily striped bass (attributable to stocking) and inland silverside. More fish were captured in Pond 3 than Pond 2, primarily Shimofuri goby (*Tridentiger bifasciatus*), longjaw mudsuckers (*Gillichthys mirabilis*), inland silverside, and rainwater killifish (*Lucania parva)*. No fish were captured in Pond 4 (Takekawa et al. 2000). Fish surveys were not conducted as part of the studies by Takekawa et al. (2000) in Ponds 5, 6, 6A, 7, 7A, or 8 because of elevated salinity levels. Fish surveys conducted as part of the restoration of Pond 2A revealed 19 species in this pond (MEC Analytical Systems 2000).

Invertebrate surveys in 1999 revealed 62 macroinvertebrate taxa groups. The greatest number of taxa occurred in Ponds 1 and 2, including 12 polycheate worms, six bivalves, 20 crustacean taxa, 12 insect families, and 12 other taxa. Pond 3 was notably lower with nine taxa, and Ponds 4 and 7 contained six and three taxa, respectively. (Takekawa et al. 2000).

The DFG fish surveys collected several special-status species and/or evolutionarily significant units (ESUs) in San Pablo Bay. It is difficult to quantify the precise number of special-status species collected and whether the chinook salmon that were taken belonged to the Sacramento River winter-run ESU (listed as endangered under ESA [59 FR 440, January 4, 1992] and CESA); the Central Valley spring-run ESU (listed as threatened under ESA [64 FR 50393, September 16, 1999] and CESA); or the Central Valley fall-run/late fall–run ESU (a federal candidate species [64 FR 50393, September 16, 1999]), and a California species of special concern [SSC]); Central Valley fall-run and late fall–run chinook salmon have been designated by NMFS as a single ESU.

A fish rescue conducted by SCWA staff on August 17, 2000, to remove fish stranded by cofferdams revealed the following species (listed in Table 7-3) in Hudeman Creek:

Table 7-3. Aquatic Species in Hudeman Creek

Common Name	Scientific Name
Yellowfin goby	*Acanthogobius flavimanus*
Mosquitofish	*Gambusia affinis*
Shimofuri goby	*Tridentiger bifasciatus*
Bay shrimp	*Crangon franciscorum*
Prickly sculpin	*Cottus asper*
Threespine stickleback	*Gasterosteus aculeatus*
Inland silverside	*Menidia beryllina*
Mitten crab (captured and destroyed)	*Eriocheir sinensis*

Source: Martini pers. comm.

None of these species are designated threatened, endangered, or of concern by federal or state resource agencies. However, Hudeman Creek and Slough are considered a portion of the Napa River Unit and could potentially provide habitat for the special-status species described in Section 7.1.4.3 below.

No specific studies have been conducted to determine species occurrences in Schell Slough. However, Schell Slough is considered a portion of the Napa River Unit and could potentially provide habitat for species such as those listed for Hudeman Creek (see Table 7-3) and the special-status species described in Section 7.1.4.3 below.

The Napa River provides habitat for species such as striped bass, steelhead, green sturgeon (*Acipenser medirostris*), Pacific lamprey (*Lampetra tridentata*), large- and smallmouth bass (*Micropterus salmoides, M. dolomieui*), catfish, threadfin shad (*Dorosoma petenense*), yellowfin goby, tule and shiner perch (*Hysterocarpus traski* ssp., *Cymatogaster aggregata*), delta and longfin smelt, prickly sculpin, carp (*Cyprinus carpio)*, Sacramento sucker (*Catostomus occidentalis*), and stickleback (Coats pers. comm.). Special-status species found in the Napa River are described in Section 7.1.4.3 below.

7.1.4.3 Listed and Fully Protected Species

California Freshwater Shrimp

The California freshwater shrimp (*Syncaris pacifica*) is a state-listed and federally listed endangered species. It can be found in pool areas of low-elevation, low-gradient streams, among exposed live tree roots of undercut banks, overhanging woody debris, or overhanging vegetation. It inhabits only 17 stream segments in Marin, Napa, and Sonoma Counties. The species is known to occur in Huichica Creek and portions of Sonoma Creek.

Chinook Salmon

Chinook salmon use San Francisco Bay as a migratory corridor as they move from fresh water to the ocean as juveniles and from the ocean to fresh water as adults. Adults generally use deeper channels, whereas juveniles are more likely to use shallow habitats, including tidal flats, for feeding and as refuge from predators. Chinook salmon are not likely to occur in Petaluma Creek, Sonoma Creek, or Novato Creek (Stern pers. comm.). Chinook salmon have been collected in the Napa River upstream of the project area (Napa River Fisheries Monitoring Program 2002).

Critical habitat has been designated to include San Francisco Bay north of the San Francisco–Oakland Bay Bridge for the Sacramento River winter-run ESU (58 FR 33212, June 16, 1993).

Coho Salmon

Coho salmon (*Oncorhyncus kisutch*) is federally listed as threatened and state-listed as endangered. This species is rarely found in San Pablo Bay, only occupying streams in Marin County south of the Novato Creek complex (Stern pers. comm.). Like chinook salmon, adults migrate through the deeper open-water channels, and juveniles sporadically move into the shallow bay and tidal flats for feeding. No coho salmon were collected either during the DFG surveys at any stations near the potential mitigation complexes or during the sampling associated with Pond 2A (MEC Analytical Systems 2000). Critical habitat has been designated to include the drainages of San Francisco and San Pablo Bays (65 FR 7764, February 16, 2000).

Steelhead

DFG collected a few "rainbow trout" in open water and beach surveys in the north bay. These fish were likely steelhead from the central California coast steelhead or Central Valley ESUs. Central Valley steelhead is federally listed as threatened (63 FR 13347, March 19, 1998) and is a California species of special concern. Central California coast steelhead is also federally listed as threatened (62 FR 43938, August 18, 1997) and is a California species of special concern.

Like chinook salmon, Central Valley steelhead use San Pablo Bay as a migratory route. Central California coast steelhead spawn and rear in the Petaluma River, Sonoma Creek, and Napa River and are present in San Pablo Bay near the mouths of these systems between October 1 and June 15 (U.S. Fish and Wildlife Service 1993, Stern pers. comm.).

Delta Smelt

Delta smelt is federally listed as threatened (58 FR 12854, March 5, 1993), and its critical habitat was designated on December 19, 1994. Delta smelt critical habitat includes the following geographic areas—areas of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; and the existing contiguous waters contained within the Delta. DFG surveys collected delta smelt at a moderate level in both the open water and beach surveys. Delta smelt typically occupy open surface water habitat with salinities lower than 12 ppt, and they move toward the shallow edge waters and slow-moving sloughs to spawn. Delta smelt have been captured in the 20-mm surveys conducted by DFG from 1995 through 2001, with the exception of 1997 when delta smelt apparently were absent. Three individuals were collected over a 4-year period at the Pond 2A restoration project (MEC Analytical Systems 2000).

Splittail

Splittail is a federal species of concern. ~~federally listed as threatened (64 FR 5963, February 8, 1999); no critical habitat has been designated for this species.~~ Splittail is typically found in shallow water of salinity levels lower than that of waters occupied by the special-status species described above. Splittail was very infrequently collected in the DFG open-water and beach surveys but was regularly collected during the Pond 2A restoration project (MEC Analytical Systems 2000). The species is known to occur in the Napa and Petaluma Rivers and Petaluma Marsh (U.S. Fish and Wildlife Service 1993, 1996) near the Petaluma River, Novato Creek, and South of SR 37 complexes.

Longfin Smelt

Longfin smelt is a federal species of concern and California species of special concern. It was the most abundant special-status species collected during the DFG open-water and beach surveys. Longfin smelt mainly uses open water and is rarely found in shallow areas such as those adjacent to potential mitigation complexes. No longfin smelt were collected during the Pond 2A restoration project (MEC Analytical Systems 2000), and very few were collected during the DFG beach seine samples near the project area.

Other Species

Green sturgeon, Pacific lamprey, and river lamprey (*Lampetra ayresi*) were infrequently captured in the DFG surveys and were not collected during the Pond 2A restoration project (MEC Analytical Systems 2000). Green sturgeon are demersal fish, and lamprey are anadromous fish likely to be found in open water. All three species are not currently listed but are federal species of concern and California species of special concern.

7.2 Environmental Impacts and Mitigation Measures

7.2.1 Methods and Significance Criteria

7.2.1.1 General Significance Criteria

Impacts on aquatic resources were analyzed quantitatively and qualitatively. Criteria based on the State CEQA Guidelines were used to determine the significance of aquatic resources impacts. The project would have a significant impact on aquatic resources if it would substantially

- interfere with or prevent the movement or migration of any fish species;
- reduce or degrade the habitat of a state or federal special-status species, potentially resulting in a reduction in species abundance;
- reduce the amount of aquatic habitat; or
- reduce fish populations.

The term *substantial* reduction in a population, its habitat, or its range has not been quantitatively defined in CEQA. What is considered substantial varies with each species and with the particular circumstances pertinent to a particular geographic area.

7.2.1.2 Methods

Relative to fish habitat, the primary environmental conditions potentially affected by project actions include water quality, substrate, continuity, and habitat area and type.

Water Quality

Water quality elements potentially affected by the project include salinity, DO, BOD, contaminants, water temperature, and suspended sediment. The significance of water quality impacts relative to fish habitat was determined based on whether implementation of the project would result in a substantial change in water quality that would physiologically stress sensitive fish species.

Fish respond to salinity through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. Specific responses of fish to salinity in the Napa River and sloughs have not been investigated. Salinity in the Napa River estuary and in San Pablo Bay can vary substantially throughout the year and on a daily basis for any fixed location (Table 7-3 and Figure 4-1 in Chapter 4, "Water Quality"). Salinity impacts associated with each of the options were assessed using general preference or tolerance ranges from the literature for each of the relevant life stages of the sensitive aquatic species (Table 7-4). These criteria include salinity ranges based on the measured preferences, growth, food conversion efficiencies, and swimming performance of various life stages under controlled laboratory conditions. Salinity outside the optimal range may affect the abundance of aquatic organisms through blockage of movement or migration, reduced egg viability, reduced survival of eggs to the larval stage, and reduced survival of rearing juveniles. Because numerous factors influence the response of fish to salinity regimes under natural conditions (e.g., fish size, temperature acclimation, food availability, genetic variation, water chemistry, predation, disease), the criteria are applied to assess generally whether the potential for an adverse or beneficial effect would exist given a change in salinity from baseline conditions.

Aquatic organisms that occur in the lower Napa River and San Pablo Bay are estuarine species that are currently subject to daily and seasonal changes in salinity levels. Estuarine species must be able to tolerate environmental changes (e.g., benthic species) or must be able to move to more optimal conditions (e.g., planktonic species). Physiologically, fish in salty water decrease their rate of water intake, and chloride cells in the gills remove excess salts back to the environment. What the chloride cells do not remove, the kidney will process, and saltwater fish will secrete a urine high in salt. Fish in fresh water are exposed to an environment that has less salt than the organism. The fish must drink copious amounts of water to receive the necessary salts, and then produce a highly dilute urine, once the salt has been removed from the water and taken into their bodies.

Because of the dynamic nature of their surrounding environment, estuarine fish must be able to react to fresh water and saltwater. Most estuarine species are capable of surviving a wide salinity range. Table 7-4 identifies salinity preferences for some of the species found in the lower Napa River and San Pablo Bay. Estuarine fish exposed to conditions less than optimal may move to areas with more suitable salinity.

Sessile or benthic organisms or passive swimmers are not able to move away from unsuitable conditions, and so they are much more tolerant of variable conditions. Sessile or benthic organisms such as clams typically will close their shells or burrow into the mud until conditions improve, or until they acclimate to the new conditions. The sessile and benthic communities in the Napa River are adapted to periods of high salinity, particularly during the summer months.

Similar to salinity, fish respond to water temperature through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. Although water temperature in the bay varies over a relatively narrow range during a year or over the course of a day (Table 7-3 and Figure 4-1 in Chapter 4, "Water Quality"), water temperature in shallow marsh areas may reach levels detrimental to some species. Water temperature tolerances for selected species are shown in Table 7-4.

Table 7-4. Salinity Tolerance, Temperature Preference, Timing, and Likely Presence at the Project Site for Various Fish Species

Species/Life Stage	Salinity Tolerance (ppt)	Temperature Preference (Degrees Celsius)	Timing	Likely Presence at Site
Delta smelt				
Spawning	0–6	7–22 (prefer <15)	Feb–July	Mar–May
Larvae	0–18.4	7–18	Mar–July	Mar–May
Juvenile, adult	(prefer less than 10)	< 22 but can tolerate to 28	Apr–July	Apr–June
Splittail				
Larvae	< 3		Feb–July	Feb–Apr
Juvenile, adult	0–23 (prefer 0–10)	15–23	May–July	Year round
Steelhead				
Juvenile	0–25	7–16	Jan–May	Jan–May
Fall-run chinook				
Juvenile	0–25	13–16	Jan–Jun	Jan–Jun
Winter-run chinook				
Juvenile	0–25	13–16	Dec–Apr	Dec–Apr
Spring-run chinook				
Juvenile	0–25	13–16	Nov–May	Nov–May
California halibut	18–35	15–16.5		Feb–Aug
Starry flounder	4–24		Year round	Winter and spring
Pacific herring				
Larvae (wang)	8–18	6–15	Dec–Jun	Dec–June
Northern anchovy				
Larvae (wang)	Unknown–35	10–23	Feb–Apr; Jul–Sept	Feb–Apr; Jul–Sept
Longfin smelt				
Larvae	2–18	7–14.5	Feb–Apr	Feb – Apr
Adult	0–32 (prefer 15–30)	16–18	Jan-Jun	Apr– Jun
Striped bass				
Spawning, larvae	0–Unknown	15–20	Apr–June	Apr–Jun
Juvenile, adult	0–35	up to 30	Year round	Year round
Green and white sturgeon	0–35		Year round	Year round
Rotifers	Some species prefer >5–10 while others require <5–10		Year round	Year round
Opossum shrimp	0–10		Year round	Year round

Periods of localized, high-suspended-sediment concentrations and turbidity owing to channel disturbance can result in clogging and abrasion of gill filaments. Clogging and abrasion of gill filaments could cause a thickening of the gill epithelium, resulting in reduced respiratory capacity, and an increase in stress level, reducing tolerance of a fish or other aquatic organisms to disease and toxicants (Waters 1995). Physiologically, high suspended sediment creates a loss of visual capability, leading to reduction of feeding opportunities for sight-feeding aquatic organisms and potentially affecting growth rates. High sediment~~s~~ concentrations may also smother eggs. However, high sediment levels are characteristic of tidal habitats in San Pablo Bay (e.g., marshes in the bay may accrete more than a foot of sediment a year [Siegel 1998]), and species that occur in the bay are adapted to relatively high sediment conditions.

Substrate

Dredging and construction activities could disturb existing substrates and the associated benthic organisms. The assessment is based on whether implementation of the project would result in substantial disturbance of substrate area and changes to the quantity or quality of fish habitat that could measurably affect the abundance and production of fish and other aquatic organisms.

Continuity

Continuity includes water depth, velocity, and flow connectivity conditions that support the movement and migration of fish species. Continuity affects movement by fish and other organisms and potential exposure to adverse environmental conditions (e.g., water temperature, desiccation, predation). The level of significance of impacts on fish movement was assessed based on whether the project would create conditions that would either impede movement to avoid adverse environmental conditions or impede movement to habitat needed to complete specific life history events (e.g., spawning, rearing).

Potential effects on depth and continuity include creation of intertidal areas temporarily disconnected from the estuary and entrainment in diversions. Fish near diversion points may be entrained with the diverted flow. The probability of entrainment and subsequent mortality is a function of the size of the diversion, the location of the diversion, the behavior of the fish, and other factors, such as fish screens, presence of predatory species, and water temperature. In general, larger diversions, relative to the proportion of flow diverted, entrain proportionately more fish than small diversions.

Habitat Area and Type

The project could change the area of habitat available to fish species or integral to production of food organisms. The assessment is based on whether implementation of the project would result in substantial change in species

habitat area that could measurably affect the abundance and production of fish and other aquatic organisms.

7.2.2 No-Project Alternative

7.2.2.1 Impact A-1: Reduced Water Quality as a Result of Uncontrolled Breaches of Levees

Under the No-Project Alternative, there would be no change in the management of the salt ponds by DFG. High salt conditions would continue to occur in the existing ponds closed to tidal influence, including ~~saline concentrates in Pond 8 and~~ bittern in Pond 7, a repository of concentrated soluble salts other than sodium chloride. The pond levees would continue to be subject to catastrophic failure or inundation of the ponds by high tide elevations in extreme storm events.

Following a breach of the levees, the duration and magnitude of high salinity in the Napa River would increase; a simulated summer breach on the Napa River indicated that ambient salinity would increase by approximately 12 ppt for several months (Philip Williams and Associates 2002a). A breach on a slough could result in greater effects because there would be less dilution. It is likely that levees would remain breached and high-salinity water discharged to the Napa River estuary for several weeks. Typically, levees fail in the winter when there is a greater amount of fresh water flowing downstream. The greater amount of freshwater could dilute the salt in the inundated ponds, but the initial change in salt concentration in the Napa River could be substantial, particularly if the upper ponds were breached (see Chapter 4, "Water Quality"). If the breach were to occur when the flows of the surrounding sloughs and Napa River were low, and the more sensitive life stages of aquatic organisms were present (Table 7-4), the salinity changes in the Napa River could cause substantial adverse impacts on the aquatic organisms in the vicinity. This impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.2.2 Impact A-2: Reduced Water Quality during Construction Activities

<u>Under the No-Project Alternative, ongoing erosion of inboard levees by wind and waves and scour of outboard levees, in conjunction with high tides and high rainfall events, would likely result in one or more levee breaches.</u> Repair of levees requires mobilizing construction equipment to the breach site. Contaminants (e.g., petroleum products) associated with the operation of equipment and other construction activities may enter the Napa River. The contaminants could adversely affect aquatic organisms by affecting their growth, reproduction, and overall survival.

In addition, sediment would be mobilized during repair activities. The increased suspended sediment could adversely affect benthic and planktonic organisms, including fish. The effect, however, would likely be minimal because of the relatively small area affected and the high rates of sediment mobility in the Napa River and San Pablo Bay. This impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

7.2.2.3 Impact A-3: Disturbance of Substrate and Associated Benthic Organisms during Repair of Levee Breaches

Ongoing erosion of inboard levees by wind and waves and scour of outboard levees, in conjunction with high tides and high rainfall events, would likely result in one or more levee breaches. DFG would potentially fix the levees on an emergency basis, requiring the mobilization of construction equipment to the site. Repair of breached~~the~~ levees could disturb the substrate and associated organisms in the vicinity of the breach. The levee repairs as well as levee maintenance would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after repairs are completed. This would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

7.2.2.4 Impact A-4: Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs

Levee breaches and repairs would strand fish and other aquatic organisms that move into the ponds during the period the levee fails. Whether organisms are stranded from the main population depends on the timing of the levee failure and the timing of the levee repair. Delta smelt, juvenile chinook salmon, and other species could die as a result of becoming stranded in the ponds after levee failure and before levee repair. If a substantial breach coincides with peak occurrence of a sensitive species life stage, such as larval delta smelt, and the levee is repaired during the period of species presence, species abundance during that and subsequent years could be affected. Therefore, this impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.2.5 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Ongoing operations of tide gates and pumps could entrain fish and other organisms into the ponds. Depending on the water quality and habitat in the pond, fish entrained into the ponds could live or die. With the exception of the Pond 8 intake, existing ~~Based on available information,~~ tide gates and pumps are not screened, and entrain fish—particularly into Ponds 1, 1A, 2, and 3. This practice would continue. The entrainment of some species, specifically the delta smelt, splittail, and chinook salmon, poses a problem as these species are listed under the ESA. The potential mortality of these species is considered likely as a result of predation by native and nonnative species, changing water quality conditions, or inability to escape from the ponds. Therefore, this impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

7.2.3.1 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Currently, only Ponds 1, 1A, 2, and 3 support fish life. Ponds 1, 1A, 2, 3, 4, and 7 are known to sustain macroinvertebrate life. Ponds 5, 6, 6A, and 8 are able to sustain salt-tolerant macroinvertebrates intermittently depending on their salinity levels. As water is brought into the ponds from the various intakes and tidal gates, fish or zooplankton could be entrained with the flow. The diversions, however, are small relative to the net and tidal flow volume of the affected sloughs and the Napa River, and the number of fish entrained is also expected to be proportionately small. However, the level of entrainment could be substantially greater than expected if fish behavior results in active movement into the area influenced by the diversion. Larval splittail are unlikely to be present under most circumstances because spawning occurs in areas with very low salinity and greater habitat complexity. Steelhead entrainment also would be expected to be minimal, although steelhead behavior in marsh and tidal habitats is poorly understood. Larval, juvenile, and adult delta smelt also could be entrained, although their open-water habitat would likely minimize entrainment in the diversions. Some entrained species may be capable of surviving entrainment in the ponds, depending on water quality and other environmental conditions in the pond. Under existing conditions, however, fish would be vulnerable to predation by nonnative and native species, changing water quality conditions, or inability to escape the ponds to complete their life history. This impact is considered significant. Implementation of Mitigation Measure A-1 below would reduce this impact to a less-than-significant level.

During the early stages of salinity reduction, fish and other aquatic organisms entrained into the ponds could be subjected to water quality conditions that are detrimental or even fatal. During the latter stages of salinity reduction, pond conditions would improve, providing habitat for some fish and aquatic organisms. As pond levels would change daily, fish and other organisms could become stranded and unable to leave the ponds. However, because the ponds would be inundated at least twice per day with the high tide, the stranding would be only temporary and most estuarine species are adapted to tidal variation. This impact is considered less than significant. No further mitigation is required.

Mitigation Measure A-1. Minimize Entrainment of Sensitive Species

Development and implementation of this mitigation measure will be consistent with the terms and conditions of take authorization provided under ESA and CESA consultation for the project. Monitoring for fish entrainment would be implemented during periods of potential presence of ESA–listed (i.e., delta smelt, splittail, steelhead, winter-run chinook salmon, and spring-run chinook salmon) and sensitive (e.g., green sturgeon, longfin smelt) species. The monitoring would provide an estimate of the number of each species entrained by the Pond 5 and 6 diversions. Sufficient information should be obtained to assess the relative estimated population level effect of entrainment. The additional information may include results of ongoing surveys by other entities (e.g., DFG, USFWS).

If the assessment of entrainment, based on analysis of monitoring data, indicates a potential measurable effect on population abundance and production, measures could be implemented to minimize entrainment losses. The measures may include construction of fish screens, change in operations timing, and change in location and design of intakes. Fish screens would follow the criteria established by NMFS, USFWS, and DFG and would minimize entrainment losses of juvenile and adult fish. Water quality and species monitoring stations may be established in the affected sloughs and in the Napa River to provide information on the distribution of fish species. The data would support real time operations that could minimize entrainment of all life stages, including larval and early juvenile fishes that would not benefit from fish screens. To the extent practicable, seasonal or diurnal operations that coincide with periods of minimum occurrence may be sufficient to avoid and minimize entrainment of most species life stages.

7.2.3.2 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Under this option, construction would be required to build the water intakes and discharge control structures, and maintain levees. Fish screens would be added to the intake structures on Pond 7A. DFG provides guidance for construction projects to minimize their effects on delta smelt, but these seasonal restrictions are for the Suisun Marsh and do not extend into the Napa River or San Pablo Bay (California Department of Fish and Game 1996); however, the water control

structures would be constructed in the late spring and summer months to avoid the sensitive life stages of protected species (e.g., delta smelt larvae).

The potential exists for fuel spills into the waterway during construction. Various contaminants, such as fuel oils, grease, and other petroleum products used in construction activities, could be introduced into the system either directly or through surface runoff. Contaminants may be toxic to fish or cause altered oxygen diffusion rates and acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

Adding soil to existing levees, as well as importing material or excavating an internal borrow ditch within each of the ponds, has the potential to increase the amount of sediment returned to the Napa River or Napa Slough. Consequently, the impact on the more susceptible aquatic organism communities in adjacent waters is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices" (described in Chapter 4, "Water Quality") and Mitigation Measure A-2 below would reduce this impact to a less-than-significant level.

Mitigation Measure A-2. Install Cofferdams to Minimize In-Water Construction

The Corps and DFG's contractor will install cofferdams around the in-water portion of the intakes ~~and~~, outfalls, and siphons if needed. Once the cofferdam is in place, trapped water will be pumped back to the Napa River and Napa Slough. A biologist may inspect the site at any time to ensure biologically friendly conditions. As needed, the levees will be repaired to eliminate the risk of breaching.

7.2.3.3 Impact A-7: Reduction in Aquatic Habitat Suitability because of the Deterioration of Water Quality

Initiation of the salinity reduction process as part of project operations would result in the discharge of moderately to highly saline water that could lead to the deterioration of water quality, reduction of aquatic habitat suitability for special-status species, and restriction of movement of fishery resources. There are no quantitative standards established for salinity discharges, but the San Francisco Bay RWQCB has a narrative standard that states that the allowable increase in salinity cannot adversely affect beneficial uses, such as fish. The specific water quality effects are described in Chapter 4, "Water Quality."

The extent of the project's effects on beneficial uses depends on the species' tolerance of salinity, ability of the species' life stage to move within an estuarine

system, and ability of individual fish to maintain their position relative to different salinity gradients. While some measures would be in place to protect aquatic resources, such as limiting the discharge of water from the lower ponds to a dilution ratio of no less than 10:1 and limiting the dilution of Pond 7 to a ratio of less than 100:5, a substantial increase in salinity could pose a problem to some species. For example, the delta smelt's use of the Napa River above the project area may be inhibited if a salinity gradient is substantially greater than existing conditions. However, the gradient would not be uniform across the Napa River and would affect the portion of the river within the plume of discharged water. In addition, most estuarine species are adapted to changing salinity and will maintain their position in the appropriate salinity gradient. The effects of increased salinity could be nominal if the total salinity thresholds are controlled. Fish typically would move on the tides and maintain their position in their desired salinity range. Benthic organisms are also adapted to changing salinity, as long as the salinity does not increase above present annual maximums.

Other constituents could also affect receiving waters and be toxic to aquatic organisms, degrading habitat and affecting fish populations. Because of potential adverse affects on aquatic habitat suitability and fish populations, this impact is considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring";
- WQ-3, "Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements";
- WQ-4, "Monitor Pond Water Quality and Use Adaptive Management"; and
- A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources" (described below).

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, "Water Quality."

Mitigation Measure A-3. Assess and Maintain Salinity Levels Protective of Aquatic Resources

The data developed through Mitigation Measure WQ-4 will be assessed relative to the salinity and other water quality requirements of listed and sensitive fish species, including delta smelt. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance and production for listed and sensitive fish species (Table 7-4), measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, duration, and frequency and change in design of discharge facilities. The data would support real time operations that could minimize effects on all life stages. To the extent practicable, seasonal or diurnal operations that coincide with periods of minimum occurrence may be sufficient to avoid and minimize water quality effects.

7.2.3.4 Impact A-8: Disturbance of Substrate and Associated Benthic Organisms during Construction Activities

The construction of the control structures as well as levee maintenance would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after construction is completed. Movement of substrate would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. No mitigation is required.

7.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are similar to those under Salinity Reduction Option 1A (Impacts A-5, A-6, A-7, and A-8). The primary difference for Option 1B would result from breach of Pond 3 levees that would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide with a period of relatively high outflow and decreasing salinity in the receiving water body. Key differences in biological effects are described below.

7.2.4.1 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Potential effects on fish would be the same as described under Salinity Reduction Option 1A for Ponds 1, 1A, 2, 4, 5, 6, 6A, 7, and 8. As water is brought into the ponds from the various intakes and tidal gates, fish or zooplankton could be entrained with the flow. Entrainment of fish and other aquatic organisms under Salinity Option 1B, however, would be less than under Salinity Option 1A because Pond 3 would be opened to tidal action via a 50-foot-wide breach. Movement of fish and other organisms with tidal flow through the breach, either into or out of Pond 3, would be unimpeded. Most mobile aquatic species would move in and out of the pond on their own volition. The impact of fish entrainment in ponds not breached is considered potentially significant. Implementation of Mitigation Measure A-1, "Minimize Entrainment of Sensitive Species," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

7.2.4.2 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Salinity Reduction Option 1B, with breach of Pond 3, would have fewer in-water construction elements and therefore fewer potential effects on aquatic habitat suitability. Instead of intakes and outfalls, this option would provide one 50-foot breach on Pond 3. Breaching Pond 3 would result in a temporary increase in sediment associated with opening the breach. The effects of short-term temporary increases in suspended sediment would dissipate over a relatively small area and during a relatively short period. The change in suspended sediment attributable to levee breach is not expected to be substantially greater than the sediment carried during a 2-year storm event. Other construction activities would be the same as under Salinity Reduction Option 1A. The potential impact on the more susceptible aquatic organism communities in adjacent waters is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices" (described in Chapter 4, "Water Quality") would reduce this impact to a less-than-significant level.

7.2.4.3 Impact A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality

Compared to Salinity Reduction Option 1A, the primary difference for Option 1B would result from breach of Pond 3 levees that would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide with a period of relatively high outflow and decreasing salinity in the receiving water body. The breach of Pond 3 would occur following a high streamflow event that reduces salinity in the Napa River (Figure 4-9). The increase in salinity in the Napa River in response to high saline flow from Pond 3 could increase salinity to approximately 7 ppt, which would dissipate to less than 5 ppt within 48 hours (Philip Williams and Associates (2002b). Prior to the high streamflow, however, salinity in the Napa River was higher than the short-term maximum in response to the breach. The increase in salinity is relatively local, affecting an area extending approximately 0.5 mile upstream and downstream of the Pond 3 breach. The increase in salinity attributable to the breach occurs immediately following an equivalent or greater rate of decrease in salinity, and the area affected is relatively local. The biological effect is likely minimal because the organisms present would of necessity be either tolerant of a wide range in salinity (e.g., benthic organisms) or sufficiently mobile to move quickly to suitable salinity conditions. The area affected and the duration of effect are relatively small.

Option 1B would result in a more rapid rate of desalination in the ponds than would Salinity Reduction Options 1A and 2 and could avoid chronic local effects associated with long-term salinity reduction options. However, potential adverse

effects of salinity reduction in the remaining ponds on aquatic habitat suitability and fish populations are considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring";
- WQ-3, "Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements";
- WQ-4, "Monitor Pond Water Quality and Use Adaptive Management"; and
- A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources."

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, "Water Quality." Measure A-3 is described under Salinity Reduction Option 1A.

7.2.4.4 Impact A-8: Disturbance of Substrate and Associated Benthic Organisms during Construction Activities

The construction of the control structures, levee maintenance, and levee breaching would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after construction is completed. This disturbance would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. No mitigation is required.

7.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1B (Impacts A-5, A-6, and A-8). The primary difference between Option 1C and Option 1B is the breach of Pond 4, as well as Pond 3, during high streamflow events as described below.

7.2.5.1 Impact A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality

Compared to Salinity Reduction Option 1B, the primary differences for Option 1C result from breaching Pond 3 and Pond 4/5 levees. The breach of Ponds 3 and 4 would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide

with a period of relatively high outflow and decreasing salinity in the receiving water body. Biological effects are similar to those described for Salinity Reduction Option 1B and are likely minimal because organisms present would of necessity be either tolerant of a wide range in salinity (i.e., benthic organisms) or sufficiently mobile to move to suitable salinity conditions. The increase in the Napa River would be approximately 18 ppt dropping to approximately 12 ppt in 48 hours and dissipating to less than 5 ppt within 2 weeks. The area affected by the increase in salinity would be approximately 2.5 miles (4,000 meters) along the Napa River (Figure 7-1).

Salinity Reduction Option 1C would result in a more rapid rate of desalination in Ponds 3 and 4 than would Salinity Reduction Options 1A and 2 and could avoid chronic local effects associated with long-term salinity reduction options. However, potential adverse effects of salinity reduction in the remaining ponds on aquatic habitat suitability and fish populations are considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring";
- WQ-3, "Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements";
- WQ-4, "Monitor Pond Water Quality and Use Adaptive Management"; and
- A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources."

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, "Water Quality." Measure A-3 is described under Salinity Reduction Option 1A.

7.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts A-5, A-6, and A-8. Impact A-7 is slightly different and is described below. Under this option, the alteration of water quality resulting from project discharge would affect San Pablo Bay, a typically high saline environment, instead of Napa Slough. Ponds 7, 7A, and 8~~,~~ ~~the high-salinity and bittern ponds,~~ would be discharged through Ponds 6, 6A, 2, 1A, and 1 and then into San Pablo Bay. Ponds 3, 4, and 5 would be discharged to the Napa River. Construction and entrainment effects would be similar to those identified in Salinity Reduction Option 1A.

7.2.6.1 Impact A-7: Reduction in Aquatic Habitat Suitability because of the Deterioration of Water Quality

The effects on the Napa River would be less than those under Option 1A because less project water would be discharged into the river, but implementation of Mitigation Measure A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources," would reduce the impact on delta smelt and other fish species to less than significant. This measure is described under Salinity Reduction Option 1A.

Water quality in Ponds 1, 1A, and 2 could be substantially degraded by diluting and mixing bittern in these ponds before discharging it to San Pablo Bay. Bittern dilution would occur only at approximately 1:40, or 2 to 2.5 times the allowable open water discharge concentration. This elevated discharge of bittern could adversely affect aquatic habitat, creating unsuitable conditions for fish and aquatic invertebrates. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level.

San Pablo Bay forms shallow open water with extensive mudflats and marshes along its northern borders. It contains a large volume of water, receiving inflow from Suisun Bay, as well as freshwater systems including the Napa River. Freshwater inflows are usually higher during the rainy season, from November to April, but the level of inflow varies from year to year. San Pablo Bay is so saline that it is unlikely to support delta smelt and splittail except for a short duration during the wettest years when these species are carried downstream.

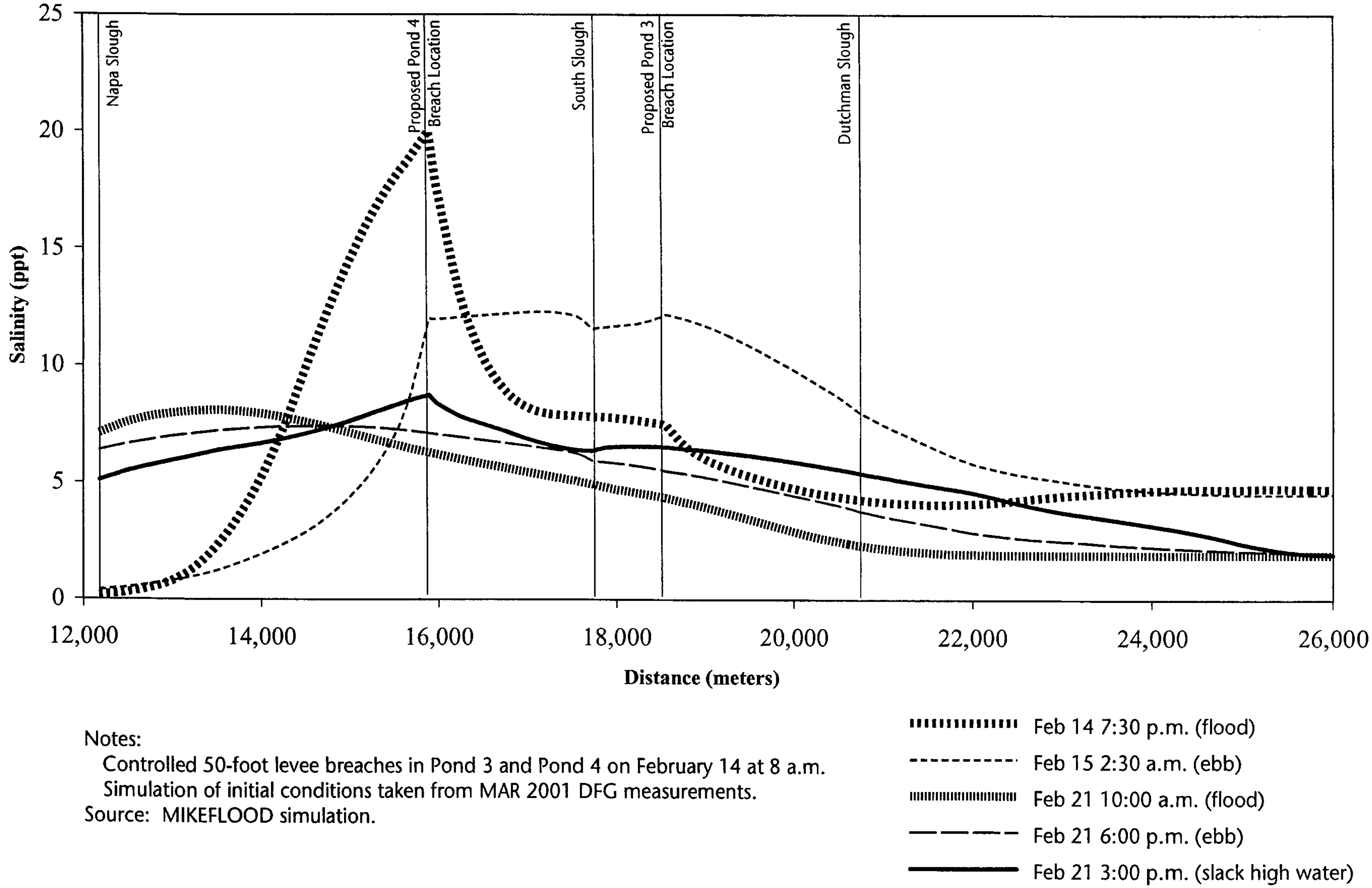
The effect of discharging higher salinity water to San Pablo Bay is expected to be negligible for aquatic resources because of the species' ability to avoid the discharge and because the discharge would not affect the overall salinity level of San Pablo Bay. Therefore, the impact on San Pablo Bay is considered less than significant. No further mitigation is required.

7.2.7 Water Delivery Option

7.2.7.1 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Water Delivery Project Component

Construction of the Sonoma Pipeline would cause no reduction in fish populations or aquatic habitat during creek crossings because construction activities would be conducted using jack-and-bore or other trenchless techniques, and erosion control measures as outlined in Chapter 4, "Water Quality," would



Notes:
Controlled 50-foot levee breaches in Pond 3 and Pond 4 on February 14 at 8 a.m.
Simulation of initial conditions taken from MAR 2001 DFG measurements.
Source: MIKEFLOOD simulation.

Source: Philip Williams Associates 2002

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PWA

Figure 7-1
Changes in Napa River Salinity

be implemented. SVCSD currently releases its treated wastewater into Schell and Hudeman Sloughs during the wet season. This incremental loss of water source would only occur during the wet season and is not expected to result in a substantial overall reduction in the amount of aquatic species habitat or species abundance in the subject sloughs. This impact is considered less than significant. No mitigation is required.

Construction of the Napa Pipeline would cause no degradation or reduction in fish populations or aquatic habitat in all but a single drainage because construction activities would be conducted using jack-and-bore or other trenchless techniques or bridge attachment methods (as on the Carneros Creek crossing). An unnamed drainage on the Stanly property would be crossed using open-trench methods. This drainage is ephemeral and would be crossed only when dry, thereby avoiding any impacts on aquatic habitat. Also, erosion control measures as outlined in Chapter 4, "Water Quality," would be implemented along the Napa Pipeline. NSD currently releases its treated wastewater into the Napa River during the wet season and only when a 10:1 dilution can be achieved. The loss of this water source to the Napa River would not substantially reduce aquatic species habitat or abundance. This impact is considered less than significant. No mitigation is required.

Construction of the CAC pipeline would cause no degradation or reduction in fish populations or aquatic habitat because construction activities would use an existing pipeline to cross the Napa River, thereby avoiding the need for construction in aquatic habitat. Also, erosion control measures as outlined in Chapter 4, "Water Quality," would be implemented. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the potential future pipelines have not yet been determined. It is anticipated that the use of jack-and-bore or other trenchless methods would be used to some degree on most, if not all, of the potential future pipelines in order to reduce or avoid potential impacts on waterways. At present, however, there are no specific construction plans. Therefore, there is the potential that pipeline construction would occur directly across creeks and substantially reduce or degrade aquatic species habitat and species abundance. This impact is considered significant. Implementation of Mitigation Measure A-4 would reduce this impact to a less-than significant level.

The WWTPs operated by the LGVSD, Novato SD, and the City of Petaluma currently release their treated wastewater into Gallinas and Miller Creek and the Petaluma and Napa Rivers, respectively. The loss of this water source to Gallinas and Miller Creeks and the Petaluma River would not substantially reduce aquatic species habitat and abundance.

Mitigation Measure A-4: Use Trenchless Technology during Construction to Protect Aquatic Species
Jack-and-bore or other trenchless methods will be used for the crossing of existing creeks and streams by potential future pipelines.

7.2.7.2 Impact A-9: Substantial Interference with the Movement or Migration of Fish Species

Water Delivery Project Component

Installation of the Sonoma Pipeline would not affect the movement or migration of fish species at creek crossings because construction activities would be conducted using jack-and-bore or other trenchless techniques. Implementation of the Water Delivery Option from SVCSD would remove all wastewater discharges into Schell Slough and the majority of discharges into Hudeman Slough. This incremental loss of water source would occur only during the wet season and is not expected to result in a substantial overall reduction in the amount of aquatic habitat for fish movement and migration in the subject sloughs. Therefore, this impact is considered less than significant. No mitigation is required.

Installation of the Napa Pipeline would not affect the movement or migration of fish species at creek crossings in all but a single drainage because construction activities would be conducted using jack-and-bore or other trenchless techniques or bridge attachment methods (as on the Carneros Creek crossing). An unnamed drainage on the Stanly property would be crossed using open-trench methods. This drainage is ephemeral and would be crossed only when dry, thereby avoiding any impacts to the movement or migration of fish species. The removal of wastewater discharge to the Napa River would not have any impact because of the required 10:1 dilution rate. Therefore, this impact is considered less than significant. No mitigation is required.

Installation of the CAC Pipeline would not affect the movement or migration of fish species at creek crossings because construction activities would use an existing pipeline to cross the Napa River, thereby avoiding the need for construction in aquatic habitat. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined. It is anticipated that the use of jack-and-bore or other trenchless methods would be used to some degree on most, if not all, of the potential future pipelines to reduce or avoid potential impacts on waterways. At present, however, there are no specific plans, provisions, or commitments to use jack-and-bore or other trenchless methods for those potential future pipelines; hence, there is the potential that pipeline construction would

occur directly across creeks and streams and that impacts on the movement or migration of fish species would occur. This impact is considered significant. Implementation of Mitigation Measure A-4, "Use Trenchless Technology during Construction to Protect Aquatic Species," would reduce this impact to a less-than-significant level. This measure is described under Impact A-6 above.

7.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

7.2.8.1 Beneficial Impact A-10: Substantial Increase in Habitat Area and Types

Many aquatic species prefer shallow-water conditions. For example, splittail require shallow habitat for spawning and larval rearing. This option would improve habitat area and complexity. The project would result in the reestablishment of natural structural features (i.e., increased marsh and shallow and deepwater areas), which would potentially reactivate and maintain ecological processes that sustain healthy fish, wildlife, and plant populations.

The restored habitat types under this option would include substantial new subtidal habitat.

This option would result in a greater variety of slough channel sizes, a large increase in slough habitat, and greater connections among San Pablo Bay, the Napa River, and the tidal salt marsh, which would be beneficial to estuarine fish, including the listed fishes, as well as other aquatic species (e.g., Dungeness crab). There would be large tracts of tidal marsh that extend up the Napa River that allow fish and wildlife species to adjust to changes in salinity that occur seasonally and over longer periods because of variations in precipitation.

This option would also improve tidal circulation throughout the system, improving water quality. It would also greatly increase production of organic detritus by tidal marshes, increasing the ecological productivity of San Pablo Bay. Finally, this option would provide a natural, self-sustaining system that could adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

The provision of cover and rearing habitat as a result of this option is considered a beneficial impact. No mitigation is required.

7.2.8.2 Impact A-11: Short-Term Construction-Related Impacts

Impacts on aquatic resources under this option are similar to those under Salinity Reduction Options 1 and 2. Under this option, there would be construction

involved in removing intake and outfall structures and replacing them with breaches that provide for maximum tidal exchange; breaching levees in areas with minimal existing marsh, and near historical channels to encourage the scouring of remnant slough channels; filling the borrow ditches adjacent to levee breaches with sediment to keep them from capturing tidal circulation; and regrading select unneeded levees at or slightly above MHHW.

This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.8.3 Impact A-12: Stranding of Fish in Restored Tidal Habitat

Once the ponds are opened up for use by aquatic organisms, there is a potential for stranding in pans (areas that are disconnected at low tide). Depth, water temperature conditions, and salinity would limit the use of these areas and provide cues for movement out of the marsh habitat on declining tides. This is a natural condition and occurs in other tidal marsh, mudflat, and shallow-water areas, and the pans are reinundated on the next incoming tide. The design of borrow ditch blocks also minimizes potential for stranding in borrow ditches that surround the ponds. Therefore, this impact is considered less than significant. No mitigation is required.

7.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.9.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as under Habitat Restoration Option 1 except that construction of the new levee in Pond 2 would require in-water construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.10 Habitat Restoration Option 3: Pond Emphasis

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.10.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as that under Habitat Restoration Option 1 except that improving the levee between Ponds 4 and 5 would require in-water construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.11 Habitat Restoration Option 4: Accelerated Restoration

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.11.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as that under Habitat Restoration Option 1 except that there would be more active management in the development of the different habitat types. Increasing the number and length of starter channels and importing sediment are proposed under Habitat Restoration Option 4. These enhanced design features would result in increased amounts of construction in the ponds but could shorten the period prior to realizing restoration benefits. The construction impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

Chapter 8
Geology and Soils

8.1 Environmental Setting

8.1.1 Introduction and Sources of Information

This chapter describes the geology, soils, and seismicity in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Sources of information used in preparation of this chapter, in addition to regulations, include various maps, articles, tables, and reports from USGS. Information about the regional and project settings obtained from USGS includes data pertaining to slides and earthflows, soil types, fault lines, Quaternary deposits, and liquefaction susceptibility. Additionally, information was obtained from reports published by scientists/geologists working in the San Francisco Bay area and conversations with engineers familiar with the project area.

8.1.2 Regulatory Setting

Various state and local regulations apply to geologic hazards and geotechnical practice in the Bay Area. These include the California Alquist-Priolo Earthquake Fault Zoning Act, the Seismic Hazards Mapping Act, and the uniform building code (UBC), as well as county and city regulations that address geologic hazards as they relate to grading and construction activities. The following sections provide additional information on the three primary geologic/geotechnical regulations.

8.1.2.1 Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code Section 2621 *et seq.)* was originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and was renamed in 1994. The Alquist-Priolo Act prohibits the location across the traces of active faults of most types of structures intended for human occupancy and strictly regulates construction in the corridors along active faults (earthquake fault zones). The act

is intended to reduce the hazard to life and property from surface fault ruptures during earthquakes. It also defines criteria for identifying active faults, giving legal definition to terms such as *active*, and establishes a process for reviewing building proposals in and adjacent to earthquake fault zones.

Under the Alquist-Priolo Act, if faults are "sufficiently active" and "well-defined," they are zoned differently, and construction along them is regulated more stringently. A fault is thought of as *sufficiently active* if one or more of its segments or strands show evidence of surface displacement during Holocene time (approximately the last 11,000 years). A fault is considered *well-defined* if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant 1997).

8.1.2.2 Seismic Hazards Mapping Act

Intended to reduce damage resulting from earthquakes, the Seismic Hazards Mapping Act of 1990 (California Public Resource Code Sections 2690–2699.6) is similar to the Alquist-Priolo Act. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are conceptually similar to those of the Alquist-Priolo Act. The state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development in mapped seismic hazard zones.

Permit review is the primary method for local regulation of development under the Seismic Hazards Mapping Act. More specifically, cities and counties are prohibited from issuing development permits for sites in seismic hazard zones until appropriate site-specific geologic and/or soils investigations have been carried out and measures to reduce potential damage have been incorporated into the development plans.

8.1.2.3 Construction Permitting and Site-Specific Geotechnical Investigations

Construction activities are regulated by local jurisdictions through a multistage permitting process. Construction permitting is overseen by the immediate local jurisdiction. Projects proposed for unincorporated lands require county permits; projects in incorporated areas (within city limits) usually require only city permit review. Grading and building permit applications both require completion of a site-specific geotechnical evaluation overseen by a state-certified engineering geologist and/or geotechnical engineer.

In order to provide appropriate construction design, the site-specific geotechnical investigation provides a geologic basis for development. Geotechnical investigations typically assess the following parameters:

- bedrock and Quaternary geology,
- geologic structure,
- soils, and
- previous history of excavation and fill placement.

As appropriate, they may also address the requirements of the Alquist-Priolo Act and the Seismic Hazards Mapping Act.

8.1.3 Regional Setting

The region is located in California's geologically active Coast Ranges Geomorphic Province. The province is characterized by a series of northwest-trending mountain ranges, valleys, and faults. The dominant geologic processes that have shaped the San Francisco Bay region are active faulting along the San Andreas, Hayward, and other faults; uplift and erosion of the east bay and peninsular hills; and subsidence of the San Francisco Bay basin.

The San Francisco Bay region appears to be a pull-apart basin that has been continuously subsiding since late Quaternary time (the past 700,000 years) in response to local crustal subsidence between the San Andreas and Hayward faults. The stratigraphy beneath the San Francisco Bay region records changes in depositional environments resulting from changes in sea level. The primary geological units that underlie a large part of the San Francisco Bay region are the Alameda Formation, Old Bay Mud, San Antonio Formation, Young Bay Mud, and the Temescal Formation.

Regional geologic features are depicted, within the scope of the area encompassed under the Water Delivery Option, in Figure 8-1.

8.1.3.1 Formations

The Franciscan Formation basement was above sea level and exposed to dissection by rivers and streams. As the basement began to subside between 1,000,000 and 500,000 years ago, the initial unit deposited on its surface was the Alameda Formation. As the basin continued to subside and the sea level abruptly rose at the beginning of the last interglacial episode, about 115,000 years ago, the Pacific Ocean fully entered the region, depositing the Old Bay Mud on top of the Alameda Formation erosional surface. The Old Bay Mud is thicker than 50 feet beneath the central part of the bay, with a maximum thickness of more than 100 feet just east of Yerba Buena Island. During the Wisconsin glacial stage, the sea level fell, exposing the Old Bay Mud to subaerial erosion. The San Antonio

Formation was deposited onto the Old Bay Mud. The San Antonio Sediment, typically 25 feet thick, was deposited in complex, dynamic depositional environments that include alluvial fans, floodplains, lakes, swamps, and beaches. The individual units are discontinuous and difficult to correlate regionally. Young Bay Mud was deposited on top of the San Antonio Formation after another rise in sea level beginning between 11,000 and 8,000 years ago. Young Bay Mud is a series of unconsolidated muds deposited in quiet water characterized by high initial void ratios and low unit densities.

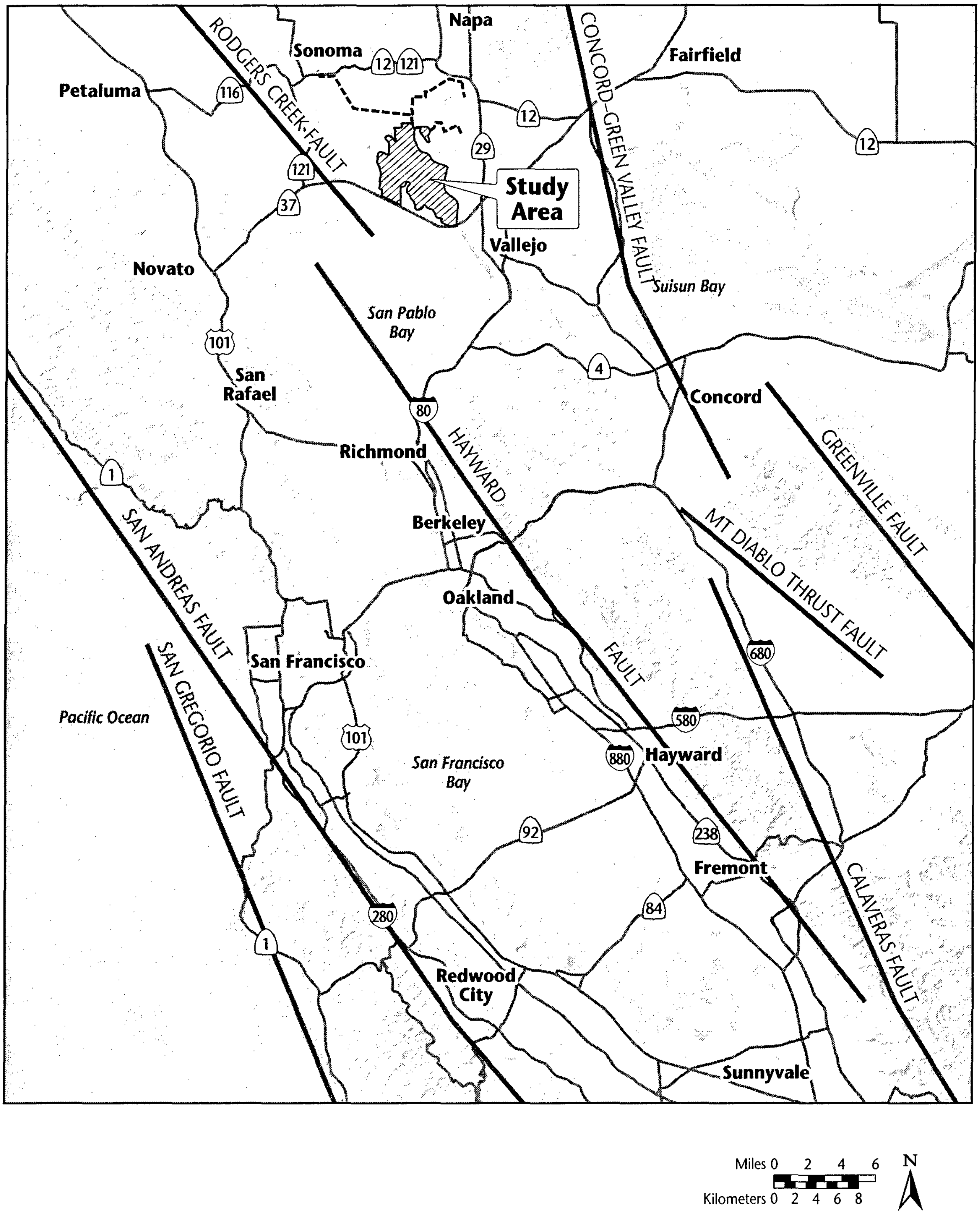
The San Francisco Bay area lies within the active San Andreas fault system. Major faults in the area include the Hayward, San Andreas, Calaveras, and Concord faults (Figure 8-2). The region is therefore subject to potential significant ground shaking from earthquakes along these faults and other faults in the San Andreas system.

During the last 160 years, the San Andreas fault system has produced numerous small-magnitude and a dozen moderate- to large-magnitude earthquakes (magnitude >6) in the Bay Area (SAIC 1997). USGS has estimated a 70% probability that one or more earthquakes with a Richter magnitude of 6.7 or greater will occur in the Bay Area in the 30-year period between 2000 and 2030 (U.S. Geological Survey 1999). The Working Group on California Earthquake Probabilities estimated an approximately 67% probability of one or more large (magnitude >7) earthquakes occurring in the Bay Area between 1990 and 2020.

8.1.3.2 Tsunamis

Tsunamis are seismically induced floods caused by the transfer of energy from an earthquake epicenter to coastal areas by ocean waves. Although tsunamis are generated in many areas around the Pacific Rim, only Alaska's Aleutian Trench could generate tsunamis capable of causing significant runups in northern California. The last noticeable tsunami observed in San Francisco Bay was the result of the Great Alaskan Earthquake of 1964. Significant damage along the west coast from that tsunami was restricted to Crescent City, located on unprotected coastline more than 250 miles northwest of the project area. Also, the project area is located adjacent to the bay. Tsunami heights are greatly reduced once they enter the bay through the Golden Gate Gap.

Tsunamis that enter San Francisco Bay decrease in height within the bay. The Great Alaskan Earthquake produced a maximum recorded runup of 7.5 feet at the Golden Gate Bridge, but no significant damage was reported. Because San Francisco is oblique, not direct, to waves traveling from Alaska, wave magnitudes were significantly weakened.



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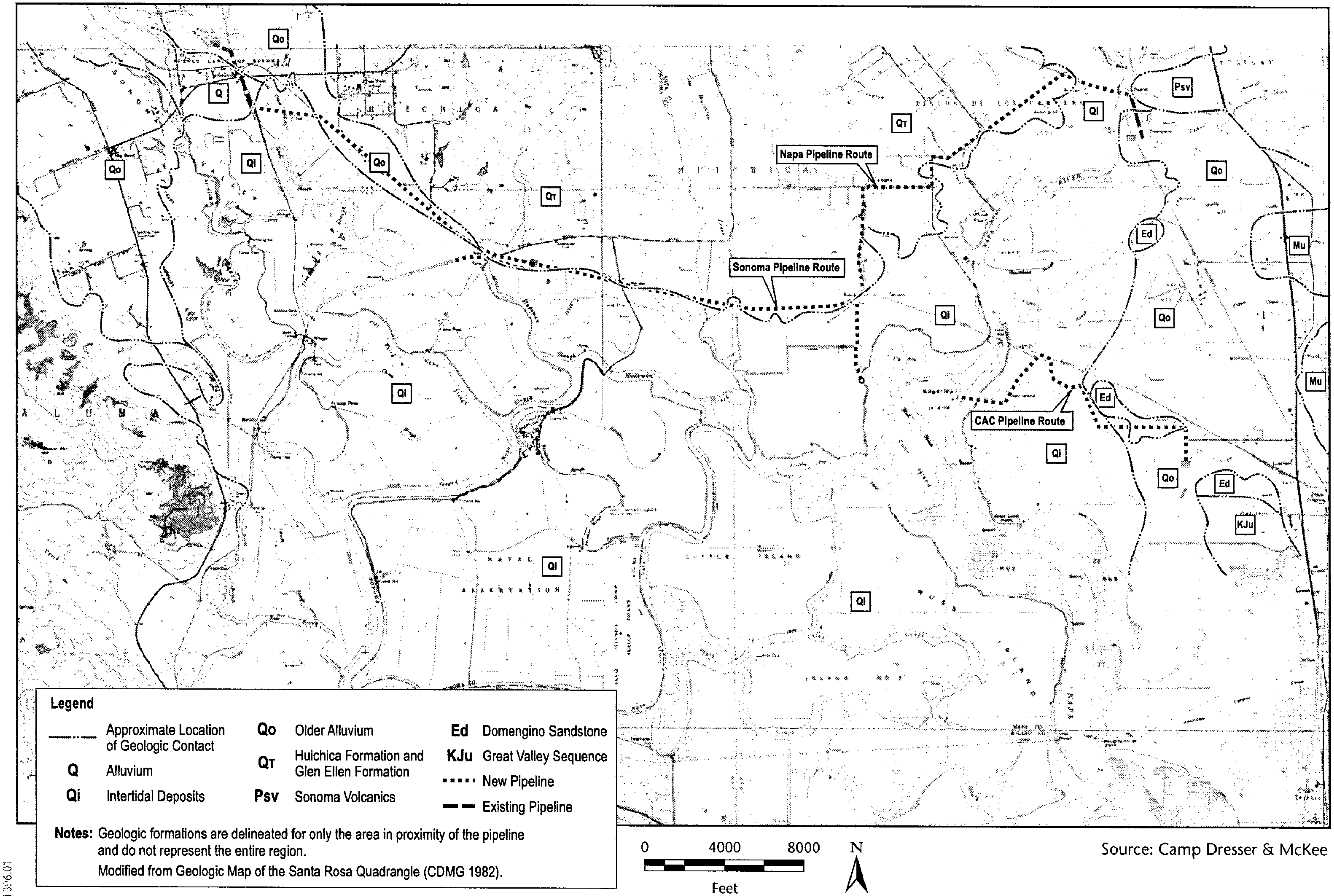
Jones & Stokes

Figure 8-1
Regional Faults



Source: Camp Dresser & McKee

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Jones & Stokes

Figure 8-2
Geologic Formations

8.1.4 Project Setting

The following sections provide additional information on the topography, geology, soils, and known geologic hazards of the project site and adjacent areas. Each of the sections below discusses the following:

- the project area for the salinity reduction and habitat restoration options (i.e., the Napa River Unit);
- the area for the Project Component of the Water Delivery Option (i.e., the corridors along the Napa, Sonoma, and CAC Pipelines); and
- the area for the Program Component of the Water Delivery Option (i.e., the connection of effluent pipelines from the LGVSD, Novato SD, and City of Petaluma WWTPs).

8.1.4.1 Topography

Napa River Unit

The Napa River Unit consists primarily of former mudflats and marshlands that have been isolated from tidal action by levees. These levees extend along the banks of the Napa River and surround the individual ponds formerly used in the production of salt. The Napa River levees are owned and maintained by local public agencies and private property owners. The salt pond levees are currently owned by the State of California and are not maintained for flood protection purposes.

Water Delivery Project Component Area

The corridors for the Sonoma, CAC, and Napa- Pipelines share similar flatland topography, except for isolated areas along localized stream channels and drainage culvert locations. Elevations range from approximately 15 feet to less than 3 feet above sea level for the Sonoma Pipeline, approximately 45 feet to less than 5 feet above sea level for the CAC Pipeline, and approximately 0 to 200 feet above sea level for the Napa Pipeline.

A vast majority of the land within both alignments was once mudflats and marshland reclaimed from San Pablo Bay by levees. Slope gradients vary from nearly horizontal to gently sloping (less than 3 feet horizontal to 1 foot vertical [3:1]) over most of the project corridor).

Water Delivery Program Component Area

The pipeline corridors proposed under the Program Component of the Water Delivery Alternative would generally follow road, highway, and railroad easements. The corridor "segments" are discussed individually below.

Las Gallinas Valley Sanitation District Wastewater Treatment Plant to U.S. 101–State Route 37 Junction

The LGVSD WWTP is located at near sea level to 20 feet above sea level. The topography of the pipeline corridor ranges from sea-level mudflats to foothills up to several hundred feet above sea level. From the WWTP site to U.S. 101, elevations vary from 3 feet to 30 feet above sea level along Smith Ranch Road. Along U.S. 101 between Smith Ranch Road and SR 37, elevations range from 30 feet to 200 feet above sea level.

Novato Sanitation District Wastewater Treatment Plant to U.S. 101–State Route 37 Junction

The Novato SD WWTP is located at or slightly below sea level along mudflats. Elevations from the WWTP to U.S. 101 along Davidson Street vary from sea level to 40 feet above sea level. From U.S. 101 at Davidson Street to the U.S. 101–SR 37 junction, elevations range from 4 feet to 40 feet above sea level.

U.S. 101–State Route 37 Junction to State Route 37–Lakeville Highway Junction

The pipeline corridor from the point where the LGVSD WWTP and Novato SD WWTP pipelines would converge (at the junction of U.S. 101 and SR 37) to the junction of SR 37 and the Lakeville Highway (from Petaluma) is characterized by largely coastal flatland topography, with elevations ranging from sea level to 40 feet above sea level.

City of Petaluma Wastewater Treatment Plant to Lakeville Highway–State Route 37 Junction

The City of Petaluma WWTP is located on coastal flatland, bordered to the south by mudflats, with elevations ranging from sea level to 10 feet above sea level. From the WWTP to the Lakeville Highway–SR 116 junction (along SR 116), the topography is characterized by rolling hills near coastal flatlands, with elevations ranging from 16 feet to 75 feet above sea level. From the SR 116–Lakeville Highway junction to the SR 37–Lakeville Highway junction (along the Lakeville Highway), elevations range from sea level to 65 feet above sea level.

State Route 37–Lakeville Highway Junction to the State Route 37–State Route 121 Junction

From the SR 37–SR 121 junction, coastal flatland topography at elevations of about 2 feet above sea level increase (traveling east) to foothills at elevations reaching over 165 feet along SR 37. Elevations return to approximately sea level at the intersection with SR 121.

State Route 37–State Route 121 Junction to Southern Pacific Railroad–Ramal Road Intersection

The corridor runs through coastal mudflats (separated by levees) along existing Southern Pacific Railroad tracks at elevations of about 7–11 feet above sea level, surrounded by flatlands at, or below, sea level. At the point where the railroad tracks cross Redding Road, the corridor follows an existing dirt road (after crossing Steamboat Slough) along Steamboat Slough at elevations of 4–9 feet above sea level. From the dirt road, the corridor meets the corridor for the Sonoma Pipeline (proposed under the Project Component of the Water Delivery Alternative) at the intersection of the Southern Pacific Railroad tracks and Ramal Road, at an elevation of 13 feet above sea level.

8.1.4.2 Geology (Stratigraphy)

Napa River Unit

The Napa River Unit lies at the north margin of San Francisco Bay, which occupies a late Pliocene structural depression encompassing the Santa Clara Valley to the south and the Petaluma, Sonoma, and Napa Valleys to the north (Norris and Webb 1990). The project area is situated in a lowland area underlain by sediments deposited in the Bay-Delta estuary over the last 2 million years.

The entire Napa River Unit is underlain by varying thicknesses of Bay Mud, a soft compressible organic-rich marine deposit of silt and clay with peat and local, thin sand and gravel lenses. San Francisco Bay has two units of Bay Mud: Young Bay Mud is nearest the surface, with Old Bay Mud (Yerba Buena Formation) found below. Nonmarine deposits, including alluvial deposits, lie between the Young and Old Bay Mud, underlie the Old Bay Mud, and also irregularly flank the margins of the marsh area. The hills that bound the Napa River Unit and the Napa and Sonoma Valleys are underlain by a variety of rock units, the most important of which are the Franciscan Formation (sandstone, shale, serpentine, and other rocks), the Chico Formation (mostly marine sandstone), the Merced Formation (Tertiary marine sands and sandstone), and the Sonoma volcanic (Tertiary volcanic flows and tuffs).

Water Delivery Project Component Area

The following sections describe the geologic units that underlie the preferred Sonoma, CAC, and Napa Pipeline alignments. The stratigraphic units described here are based on review of geologic maps for the area, except for artificial fill (California Division of Mines and Geology 1982a). Artificial fill was observed along much of the pipeline alignment corridors. Only units that would be encountered during construction are described below.

~~Summary of Earthen Materials~~

~~In summary, earthen materials likely to be encountered along all three pipeline corridors include artificial fill, native soil, Young Bay Mud, and interfluvial basin~~

~~deposits. Table 8-1 presents some of the geotechnical constraints that these materials may present to project construction.~~

Artificial Fill

Artificial fill exists extensively along the Sonoma, CAC, and Napa Pipeline alignments as evidenced by railroad and street improvements. The depth of artificial fill likely varies from a few feet up to approximately 10 feet. While information is limited to the characteristics of this deposit, artificial fill is likely composed of sand, silt, and clay mixtures originating from adjacent nearby surficial deposits. Because of the heterogeneous nature of fill materials placed along the project corridor and unknowns regarding their sources, these materials may have corrosive characteristics.

Alluvium

Young alluvium (Q) underlies a small portion of the Sonoma Pipeline near the WWTP along the NWPRA corridor. This unit is composed of loosely consolidated sand, silt, and clay mixtures with rocks up to boulder size. This unit is susceptible to liquefaction, given its loosely consolidated nature and the relatively shallow depth to groundwater.

Intertidal Deposits

Holocene age intertidal deposits (Qi) underlie or border most of the Sonoma, CAC, and Napa Pipeline corridors. These deposits are composed of soft mud and peat deposits in marshes, swamps, and adjacent waterways (California Division of Mines and Geology 1982a). The deposits interfinger with younger alluvial deposits. This unit is generally less than 20 feet thick along the pipeline alignment (California Division of Mines and Geology 1980). Intertidal deposits have poor engineering characteristics and are subject to failure during severe ground shaking.

Older Alluvium

Older alluvium (Qo) is mapped beneath the northern portion of the Sonoma Pipeline alignment. This Pleistocene unit consists of dissected alluvial deposits composed chiefly of loosely consolidated sand, silt, and clay mixtures with rocks up to boulder size. Older alluvium, as with other local deposits, is highly susceptible to liquefaction, given its loosely consolidated nature and the relatively shallow depth to groundwater.

Domengio Sandstone

The Domengio Sandstone (Ed) is Eocene-age marine quartzose sandstone and has good engineering characteristics.

Huichica Formation and Glen Ellen Formation

The Huichica Formation (Qt) of the Pleistocene age is composed of reworked tuff, weathered volcanic clay, and silt. The Glen Ellen Formation is of Plio-Pleistocene age and is composed of a heterogeneous mixture of pale buff clay, silt, sand, and gravel.

Summary of Earthen Materials

In summary, earthen materials likely to be encountered along all three pipeline corridors include artificial fill, native soil, Young Bay Mud, and interfluvial basin deposits. Table 8-1 presents some of the geotechnical constraints that these materials may present to project construction.

Table 8-1. Geotechnical Constraints of Earthen Materials

	Potential Constraint							
Material Type	Possible damage to concrete because of corrosive characteristics	Cracks in pavement or foundations resulting from high shrink/swell potential	Excessive foundation settlement resulting from high compressibility	Difficulty in excavating because of oversized materials	Instability during earthquakes because of weak or liquefiable nature	Reusability as engineered fill	Low R-value	Unsuitability as subgrade for roadways because of yielding
Fill	✓	✓	✓		✓	✓	✓	
Alluvium (Q)		✓	✓	✓	✓	✓	✓	✓
Intertidal deposits (Qi)	✓	✓	✓		✓		✓	✓
Older alluvium (Qo)	✓	✓	✓	✓	✓	✓	✓	✓
Huichica formation/Glen Ellen formation (Qt)	✓	✓	✓			✓	✓	✓
Domengio sandstone (Ed)						✓		

Water Delivery Program Component Area

The geologic units in the area of the Program Component of the Water Delivery Alternative are similar in composition to those in the Project Component area. The units largely consist of Holocène and Pleistocene alluvial deposits and bedrock. The geologic units (terranes) in the Program Component area are composed almost exclusively of Franciscan Complex and Great Valley Complex rock. The majority of the potential future pipeline alignments would be located on alluvial deposits, which exhibit low shear strength and are susceptible to failure during seismic events.

8.1.4.3 Soils

Napa River Unit

Napa River Unit soils are all of the Reyes series. These soils are silty clays deposited primarily by sediment-laden bay waters, but also by tributary freshwater streams. Slopes in the marsh range from 0 to 2%, but most are less than 1%. The soil is acidic in its undeveloped state; permeability is low; and the

erosion hazard of these soils is considered low. Levees in the project area were constructed from native bay muds of varying degrees of compaction/hardness, and were repaired using similar material (Huffman pers. comm.).

Because the levees were constructed with native material, bay muds, they are subject to erosion from wind/wave action and tidal inundation. Preliminary geotechnical surveys of the levees and a report from the on-site manager are depicted in Figure 2-2 in Chapter 2. The available information indicates the following:

- Ponds 1 and 1A have effectively become one large pond because of a breach in the levee between the two ponds. The eastern levee of Pond 1 needs to be reinforced in the next 5 years as it serves as an important staging area for individuals that need to access the pumphouse and caretaker facilities. The levee is also used as a parking lot by members of the Can Duck Club (a duck-hunting club). The northern levee of Pond 1A bordering South Slough needs reinforcement or it may be lost.
- The north and northeast levees from Pond 2 are likely to breach within the next 5 years unless they are repaired. Because of the high wind/wave action and past inability to regulate water levels in this pond, the crest of the levee is only 4–5 feet wide and has been undercut 2–3 feet in some areas.
- Approximately one-third of the eastern portion of the levee along the southern edge of Pond 3 is likely to breach within the next 5–10 years.
- Levees along the outside bends of Ponds 3, 4, and 5 have obvious scour/steep banks and are vulnerable to levee breaching within the next 5–10 years.
- There is substantial erosion of the outboard levee toe along Napa Slough on the west side of Pond 6A, just north of the dividing levee between Ponds 6 and 6A. There is also erosion on the north levee of the canal that runs along the north and east levees of Pond 6A. The eroded area is on the outboard edge (on Napa Slough) on the outer canal levee. This section of levee (approximately 100 feet long) is high and narrow with a steep dropoff into the slough. The majority of the west and north levees of Pond 6A have strips of accreted marsh protecting the existing levees.
- Significant erosion from wind/wave action is apparent at the levee between Ponds 7 and 7A.

Generally, erosion in the sloughs is low as mudflats and lower marshes have formed.

The National Earthquake Hazards Reduction Program has defined five soil types (A–E) based on their shear-wave velocity (Vs). Soils with a low shear-wave velocity experience stronger shaking, whereas soils with a high shear-wave velocity experience weaker shaking. The project site is composed predominantly of type E soil. Soil type E, composed of water-saturated mud and artificial fill, has the lowest shear-wave velocities (less than 200 meters per second) of all of the five soil types. Therefore, the strongest amplification of shaking from earthquakes is expected for this soil type.

Water Delivery Project Component Area

Sonoma Pipeline Alignment

Soils associated with the Sonoma Pipeline are assigned to the Clear Lake-Reyes, Haire-Diablo, and Huichica-Wright-Zamora associations. Soils assigned to the Haire-Diablo association underlie the area surrounding the SVCSD WWTP. The Haire-Diablo association soils are characterized as moderately well drained and well drained, gently sloping to steep fine sandy loams to clays on terraces and uplands. After crossing SR 12/121, the soils transition to the Clear Lake-Reyes association, which are characterized as poorly drained, nearly level to gently sloping clays to clay loams in basins and on tidal flats. Near the *Wye*, the soils transition to the Huichica-Wright-Zamora association, which are characterized as somewhat poorly drained to well drained, nearly level to strongly sloping loams to silty clay loams on low bench terraces and alluvial fans (U.S. Department of Agriculture 1972).

CAC Pipeline Alignment

Soils associated with the CAC Pipeline are assigned to the Reyes-Clear Lake and Haire-Coombs units. Reyes-Clear Lake soils predominate through the portion along Green Island Road and are characterized as poorly drained silty clay loams and clays deposited on tidal flats, in basins, and on basin rims. Haire-Coombs series soils are mapped near the western terminus of the pipeline segment along Green Island Road and extend to the end of the existing pipeline segment under the Napa River. Haire-Coombs series soils are characterized as nearly level to moderately steep, moderately well drained and well drained gravelly loams, loams, and clay loams on terraces.

Napa Pipeline Alignment

Soils associated with the Napa Pipeline are assigned to the Reyes–Clear Lake and Haire-Coombs units. Soils assigned to the Reyes–Clear Lake association underlie the proposed pipeline as it leaves the WWTP and crosses the Napa River. ~~Reyes–Clear Lake soils are characterized as poorly drained silty clay loams and clays deposited on tidal flats, in basins, and on basin rims.~~ As the pipeline heads southeast and then east on Las Amigas, it encounters Haire-Coombs soils. ~~This soil association is characterized as nearly level to moderately steep, moderately well-drained, and well-drained gravelly loams, loams, clay loams on terraces.~~

Water Delivery Program Component Area

The soil composition along the pipeline corridors under the Program Component of the Water Delivery Alternative includes

- Holocene San Francisco Bay Mud (Qhbm),
- Holocene alluvial fan deposits (Qhf),
- artificial fill and artificial fill over Bay Mud (af/afbm),
- undifferentiated Holocene alluvium (Qha),

- late Pleistocene fan deposits (Qpf),
- late Pleistocene to Holocene fan deposits (Qf),
- early to late Pleistocene undifferentiated alluvial deposits (Qoa), and
- pre-Quaternary deposits and bedrock (br).

Almost all of the areas proposed for the Program Component pipeline corridors occur on artificial fill (used for street/highway and railroad bed materials) over alluvial deposits and mud.

8.1.4.4 Seismicity

Napa River Unit

The Napa River Unit is located between the Rodgers Creek fault and the Concord–Green Valley fault and just north of the northern end of the Hayward fault (Figure 8-2). The closest fault is the northwest trending Rodgers Creek fault. The southern tip of this fault lies approximately 2 miles west of the project site. The Concord–Green Valley fault is approximately 15 miles to the east. The northern section of the Hayward fault, about 3 miles south of the project site, has a 32% probability of one or more magnitude 6.7 earthquakes over the next 30 years (U.S. Geological Survey 1999).

Ground shaking is the primary cause of earthquake damage to human-made structures, including levees. Areas with soft soils tend to experience stronger seismic shaking than others. Soft soils amplify ground shaking; the influence of the underlying soil on the local amplification of earthquake shaking is called the *site effect.*

Other factors influence the strength of earthquake shaking at a site as well, including the earthquake's magnitude and the site's proximity to the fault. These factors vary from earthquake to earthquake. Soft soil always amplifies shear waves. If an earthquake is strong enough and close enough to cause damage, the damage will usually be more severe on soft soils. As stated previously, the project is located on soft soils, with low shear-wave velocities that amplify shaking.

Primary Seismic Hazards—Surface Fault Rupture and Ground Shaking

No active faults have been mapped in the Napa River Unit and none of the former salt ponds are in an earthquake fault zone designated by the state under the Alquist-Priolo Act (California Division of Mines and Geology 2000). However, the active Rodgers Creek fault has been mapped as far south as Sonoma Creek (California Division of Mines and Geology 2000) and likely extends farther southeast across Sonoma Creek and south of SR 37. According to USGS and special studies maps, the Rodgers Creek fault lies approximately 2 miles west of the site. The potential for ground rupture during an earthquake is

limited to areas within 250 feet of a fault. Thus, the Rodgers Creek fault does not pose a threat of ground rupture at the project site.

Each of the 12 salt ponds has the potential to experience ground shaking as a result of seismic activity on any of the Bay Area's principal active faults. Moreover, the salt ponds are almost exclusively located on unconsolidated sediments, with Bay Mud composing each of the surrounding levees. This type of substrate has been shown to amplify and prolong ground shaking, particularly during large seismic events, and Bay Mud has a high propensity for liquefaction (U.S. Geological Survey 2000c).

Secondary Seismic Hazards—Liquefaction and Ground Failure

The 12 ponds in the Napa River Unit are located almost exclusively in areas where the existing risk of seismically induced liquefaction is high. In addition to liquefaction, corollary risks associated with seismic ground shaking include settlement in unconsolidated or weakly consolidated sediments, and lurching or lurch cracking in soft, saturated materials. Fine-grained sediments (including Bay Mud) and bedrock are unlikely to experience substantial settlement as a result of ground shaking. However, the Bay Mud that underlies much of the project site and composes the levees is considered susceptible to lurching, particularly where deposits are bordered by steep channel banks or adjacent hard grounds (Jones & Stokes 1998).

Landslide Hazards

Landslides are slides and earth flows that can pose serious hazard to property in the hillside terrain of the San Francisco Bay region. The best available predictor of where slides and earth flows might occur is the distribution of past movements (U.S. Geological Survey 2000). These landslides can be recognized from their distinctive topographic shapes, which can persist in the landscape for thousands of years.

Existing landslide hazards are minimal or nonexistent at the ~~project site~~ Napa River Unit because surface gradients are very gentle. A review of slides and earth flows for Napa County revealed that the project site is in an area of gentle slope at low elevation that has little or no potential for the formation of slumps, translational slides, or earth flows except along streambanks and terrace margins (Wentworth et al. 1997). Therefore, landslides pose little threat in the project area.

Water Delivery Project Component Area

The San Francisco Bay region is considered by geologists and seismologists to be seismically very active. Earthquakes generated along active faults may result in very strong ground motion that can cause surface rupture and severe shaking damage to structures and destabilize ground. Table 8-2 summarizes nearby active faults with respect to their closest distance from the specified pipeline corridor, maximum moment magnitude, and expected peak ground acceleration based on the likelihood of earthquake occurrence on any regional fault (probabilistic approach using chance of 10% exceedance in 50 years, alluvium

conditions) (California Division of Mines and Geology 1994, 1996, 1999). Figure 8-2~~1~~ shows the location and proximity of identified active faults to the pipeline alignments.

Table 8-2. Significant Regional Faults and Preliminary Seismic Values for Hazard Assessment

Fault	Approximate Distance from Site [a] (kilometers)	Maximum Moment Magnitude [b]
Sonoma Pipeline		
Rogers Creek Fault	5.8	7.0
San Andreas Fault	3.3	7.9
CAC Pipeline		
West Napa Fault	0	6.5
Green Valley Fault	0.8	6.9
Napa Pipeline		
West Napa Fault	1.0	6.5
Green Valley Fault	11.2	6.9
Cordelia Fault	12.8	6.7
Rodgers Creek Fault	16.0	7.0

Note:
[a] Distance from site to closest point on the identified fault
[b] from California Division of Mines and Geology Open-File Report 96-08
Source: California Division of Mines and Geology 1999.

As shown in Figure 8-1, the Sonoma and Napa Pipelines are not currently located within a special studies zone for active faults (California Division of Mines and Geology 1992). No known active or potentially active faults occur along either alignment. However, the CAC Pipeline intersects the southern segment of the active West Napa fault (California Division of Mines and Geology 1994). This fault lies to the east of the CAC Pipeline alignment and is projected to intersect the pipeline alignment west of Napa Junction.

Fault Rupture

Sonoma Pipeline. No known active faults or fault segments are mapped within the Sonoma Pipeline corridor; therefore, the potential for surface rupture because of faulting is considered low.

CAC Pipeline. As previously described, the CAC Pipeline runs to the east of the southern segment of the West Napa fault near Napa Junction. Therefore, the potential for surface rupture because of faulting is considered high during its designated maximum moment magnitude event of M_m=6.5.

Napa Pipeline. No known active faults or fault segments are mapped within the Napa Pipeline corridor; therefore, the potential for surface rupture because of faulting is considered low.

Ground Shaking

Collapsed structures, cracked walls or foundations, broken utility lines, cracked pavement, and ground failure may occur as a result of strong ground shaking during a major seismic event. Most earthquake damage is the result of ground shaking and its secondary effects (liquefaction, lurching, lateral spreading, and settlement).

USGS estimates the rates of occurrence of earthquakes and 30-year earthquake probabilities (U.S. Geological Survey 1999). The USGS study considers a range of magnitudes for earthquakes on the major faults in the region. The California Division of Mines and Geology (CDMG) also has an estimate of the range of peak ground accelerations (g) (a measure of the intensity of ground shaking during an earthquake) expected in the vicinity of the project corridor. This range may exceed 0.70 g during a major earthquake (California Division of Mines and Geology 1999). This estimate is based on probabilistic criteria of 10% chance of exceedance in 50 years and considers underlying alluvium conditions.

In addition, the majority of ~~both~~ the three pipeline alignments are underlain by shallow groundwater and soils that are conducive to liquefaction. This condition, coupled with the proximity of the pipelines to faults capable of high ground acceleration makes the underlying soils highly prone to ground failure, including liquefaction and settlement (California Division of Mines and Geology 1982b). As a result, most of the project is susceptible to the effects of ground shaking.

Unconsolidated alluvial deposits, including Bay Mud, have a lower shear velocity, which dampens ground motion and decreases peak ground accelerations. However, depending on the direction of wave propagation of the ground motion and the underlying geologic conditions, localized ground amplification effects may cause an increase in peak ground acceleration, particularly in the more damaging vertical direction. This amplification effect was experienced during the Loma Prieta earthquake that occurred on October 17, 1989, where the I-880 Cypress Freeway structure located in Oakland (62 miles from the earthquake's epicenter on the San Andreas fault, and more than 10~~7~~ miles from the project corridor) collapsed as a result of strong ground motions that were greater than in many areas closer to the causative fault.

Liquefaction

Soil liquefaction is the sudden and total loss of soil strength during earthquake-induced ground motion. Liquefaction occurs in loose, saturated, clean sand where ground shaking increases effective pore pressure resulting in the displacement of individual sand grains and groundwater. During liquefaction, the soil transforms into a fluid-like state, allowing displacement of water and the potential mobilization of sand if not confined. Soil liquefaction potential is governed by the physical properties of the soil, such as sediment grain size distribution, compaction, cementation, saturation, layer thickness, and depth. Liquefaction is also governed by the degree and duration of ground motion.

Based on review of the Association of Bay Area Governments' (ABAG's) Regional Liquefaction Map and other supporting documents, the entire project corridor is susceptible to liquefaction (California Division of Mines and Geology

1980, 1982a). Loose, poorly consolidated, saturated sand deposits that are expected to experience strong ground motion during a major seismic event underlie the area. Induced settlement, sand boils at the surface, foundation failures, and abrupt ground loss can be caused by liquefaction.

Ground Lurching

Ground lurching is the horizontal movement of ground located adjacent to slope faces during strong, earthquake-induced ground motion. The results of ground lurching include longitudinal cracking parallel to the slope face at some distance setback from the top of the slope. Areas along the pipeline ~~project~~ corridors particularly susceptible to ground lurching as a result of fill placement over soft Bay Mud and slope exposures include the section of the NWPRA rail corridor approaching the Wye and continuing east past Buchli Station Road and northeast toward the Stanly Ranch property (Figure 8-2). Other fill embankments located within the project corridor may be susceptible to ground lurching.

Lateral Spreading

Lateral spreading is the horizontal displacement of soil during strong, earthquake-induced ground motion. It occurs in loose, unconfined sedimentary and fill deposits but can also occur in consolidated fills over loose sand or soft mud deposits.

Some potential exists for lateral spreading to occur along pond levees and a portion of the Sonoma Pipeline along the section of the Northwestern Pacific Railroad corridor approaching the Wye and continuing east past Buchli Station Road and northeast toward the Stanly Ranch property (Figure 8-2).

Tsunamis and Earthquake-Induced Flooding

A review of existing data on regional tsunami potential and magnitude, predictions of rates of sea-level rises, and potential settlement rates from similar sites indicates that the pipeline surface grade is unlikely to~~may~~ experience earthquake-induced flooding. ~~However, considering that the pipeline would be below grade and that inundation would occur in low-elevation areas that are marginal to estuary waters or tidal sloughs, the resultant risk potential to the project is low.~~

~~A tsunami with a wave height of 20 feet at the Golden Gate Bridge that is predicted to occur approximately once every 200 years would result in a wave height above 10 feet south of the project corridor along South Airport Drive (Ritter and Dupre 1972). However, i~~Inundation hazards from tsunamis, wave run-up, sea level rise, or settlement are minimal because the lower project area is located in existing marshland and much of the potential wave energy would be attenuated before reaching the project areas.

Other Geotechnical Considerations

Other geotechnical considerations include settlement, erosion, landslides, and shallow groundwater.

Settlement. Earthen materials underlying the pipeline corridors are prone to settlement from increased vertical loads resulting from fill placement. If

additional loads are placed as a result of construction of the pipelines, increases in the rate and amount of settlement can be expected. In addition, as previously discussed under seismic hazards, settlement resulting from loss of soil strength during a major earthquake (i.e., liquefaction) may occur. High potential for settlement exists along the new segments of pipeline for the Sonoma, CAC, and Napa Pipelines.

Erosion. In general, soil underlying the project corridor is characterized as having low to moderate erosion potential. Erosion would be expected at unlined drainage channels and culverts that intersect the pipeline alignment.

Landslides. Because the general ~~flatland~~ topography encompassing the project corridors is flat, the risk of landslides is low, except for one location on the Sonoma Pipeline. An isolated area near Merazo along the Sonoma Pipeline is characterized as an area of "relatively low slope stability" (California Division of Mines and Geology 1980). Other areas along the pipeline corridors have the potential for experiencing relatively small "pop-outs" that could be considered a form of landslide.

Shallow Groundwater. Groundwater beneath the pipeline corridors is considered shallow, less than 10–15 feet below the ground surface. Geotechnical consequences of shallow groundwater conditions include, but are not limited to, special dewatering requirements during excavation/construction, ground instability affecting earthwork activities, and excessive water pressure and infiltration acting upon belowgrade facilities and structures.

Water Delivery Program Component Area

Because of the regional effects of seismic events, the seismic conditions for the area of the Program Component of the Water Delivery Alternative are nearly the same as those of the Project Component area.

Fault Rupture

The corridors for the potential future pipelines are located around the western edge of San Pablo Bay, between the San Andreas and Rodgers Creek faults. The corridors are in the vicinity of, and could be affected by, the San Andreas fault and the northern Hayward fault; however, the Program Component area is not located within an Alquist-Priolo fault hazard zone for these faults. The Water Delivery Program Component area is located very near, and a potential future pipeline corridor may cross, the Rodgers Creek fault. The pipeline segment affected by this fault would be within an Alquist-Priolo fault hazard zone. The potential for surface rupture from faulting is considered high for this fault during its designated maximum moment magnitude event of M_m=7.0.

Ground Shaking

The potential for ground shaking of the Water Delivery Program Component area would be similar to that for the Project Component area. The probability of ground shaking during seismic events is essentially identical for both components. Like the Project Component area, the potential future pipeline

corridors are characterized largely by unstable alluvial soils that have the potential for failure during periods of strong ground shaking, although the loosely consolidated material may dampen ground motion and decrease peak ground accelerations.

Liquefaction

Because of the predominance of alluvial soils along the Water Delivery Program Component corridors, the corridors are susceptible to liquefaction during seismic events. According to ABAG's Regional Liquefaction Map, the majority of the Water Delivery Program Component area is characterized by high to very high susceptibility to liquefaction.

Ground Lurching

The Water Delivery Program Component area has potential for ground lurching similar to that of the Project Component area. The Program Component area is predominantly flat or gently sloping, with some steeper slopes composed mostly of rock, which exhibits little potential for instability and lurching. Areas along Water Delivery Program Component corridors adjacent to slopes with alluvial soils and levees on Bay Mud are more susceptible to ground lurching.

Lateral Spreading

The Water Delivery Program Component would use corridors along existing roadways and railroads built on artificial fill over Bay Mud or other loosely consolidated alluvial soils. As such, the potential for spreading, especially for levees under loads (of cars, trains, or pipelines), is higher than in most parts of the Project Component area.

Tsunamis and Earthquake-Induced Flooding

As with the Project Component area, inundation hazards from tsunamis, wave runup, sea level rise, or settlement in the Water Delivery Program Component area are minimal because the corridors subject to any such impacts are located in existing marshland and much of the potential wave energy would be dissipated.

Other Geotechnical Considerations

Conditions in the Water Delivery Program Component area related to settlement, erosion, landslides, and shallow groundwater are described below.

Settlement. Because of the soil composition along the proposed corridors, the potential for settlement from increased loads is considered high, especially during seismic events.

Erosion. Similar to the Project Component area, soils in the Water Delivery Program Component area have low to moderate erosion potential. As such, erosion would be expected to occur at unlined drainage channels and culverts that intersect the pipeline corridor.

Landslides. Because the topography of most of the Water Delivery Program Component area is flat, the potential for landslides is low. However, in areas adjacent to slopes greater than 25%, the potential for slope failure, particularly during seismic events, is greatly increased. Moderate to high landslide risks

occur generally along such slopes, namely along the northeastern side of the Lakeville Highway north of SR 37 and along the western side of SR 121 north of SR 37.

Shallow Groundwater

Subsurface conditions, including groundwater levels, are very similar for the areas of both the Project and Program Components of the Water Delivery Alternative. As such, the Program Component area is anticipated to exhibit groundwater levels at less than 10–15 feet below ground surface in flat lowland areas, and at greater depths in foothill areas.

8.2 Environmental Impacts and Mitigation Measures

8.2.1 Methodology and Significance Criteria

Impacts on geology and soils were analyzed qualitatively based on a review of soils and existing geologic data of the project site. Criteria based on the State CEQA Guidelines were used to determine the significance of geology, soils, and seismicity-related impacts. The project would have a significant impact on geology, soils, and seismicity if it would result in

- exposure of people or structures to potential adverse effects (including the risk of loss, injury, or death) as a result of rupture, ground shaking, or ground failure;
- substantial soil erosion or the loss of topsoil;
- construction of structures on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse; or
- construction of structures on expansive soils as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property.

Furthermore, analysis of impacts related to geology, soils, and seismicity addressed the risk of personal injury, loss of life, and damage to property (including levees, utilities infrastructure, and other structures) with a specific focus on the potential for implementation of the restoration to exacerbate risks associated with known existing geologic hazards, including earthquakes, and tsunamis.

8.2.2 No-Project Alternative

8.2.2.1 Impact Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking

The project area is likely to undergo strong ground shaking from a major earthquake in the Bay Area within the next 30 years (U.S. Geological Survey 1999). Smaller seismic events are also likely to occur during this timeframe, and seismic hazards will continue to be a factor throughout the lifespan of the project. Moreover, the site is on unconsolidated sediments, which are known to amplify and prolong seismic ground shaking (e.g., Goldman 1969). Levees and utilities are thus at risk from strong seismic ground shaking. Strong seismic activity would cause already deteriorating levees to fail. Levee failure could cause sloughs to plug up. In addition, levee failure could result in a release of highly saline water and bittern into the Napa River, resulting in damage to water quality and aquatic life as described in Chapter 4, "Water Quality." This impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

8.2.2.2 Impact Geo-2: Levee Failure as a Result of Erosion

Under the No-Project Alternative, the levees in the project area would continue to deteriorate, primarily through erosion. Erosion may be caused by wind/wave action within the ponds or by scour along the outside of the ponds. In Pond 2 areas, erosion-related levee failure may occur within 5 years; in several other areas, erosion-related levee failure could occur within the next 5–10 years. This impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

8.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

The potential geological impacts associated with the project are similar for all the options. The impacts are generally associated with (1) seismic activity (ground shaking can cause levee rupture and structural damage), (2) levee breaching (potential for soil erosion), and (3) construction of recreational facilities (structures built on expansive soil). The risks of levee failure discussed in this section pertain to the actual potential of the levee to fail and any direct impact on people or structures as a result of that failure.

8.2.3.1 Impact Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking

As mentioned above under the No-Project Alternative, the project site is likely to undergo strong ground shaking from a major earthquake in the Bay Area within the next 30 years (U.S. Geological Survey 1999). Smaller seismic events are also likely to occur during this timeframe, and seismic hazard will continue to be a factor throughout the lifespan of the project. Moreover, the site is on unconsolidated sediments, which are known to amplify and prolong seismic ground shaking (e.g., Goldman 1969). Levees, water control structures, utilities, and recreational facilities are thus at risk of damage from strong seismic ground shaking.

Under Salinity Reduction Option 1A, repairs and upgrades to existing levees and water conveyance/control structures would be performed. The levees and water control structures would also receive regular maintenance. In addition, new control structures would be engineered to withstand seismic events to the extent practicable. Because of the repairs, proper engineering of new facilities, and ongoing maintenance, this impact is considered less than significant. No mitigation is required.

8.2.3.2 Impact Geo-3: Levee Failure or Structural Damage as a Result of a Rupture of a Known Earthquake Fault

According to USGS and special studies maps, the nearest known and mapped fault is the Rodgers Creek fault, which lies approximately 2 miles west of the project site. Because of the distance to this fault, surface fault rupture is unlikely to pose a substantial risk of personal injury, loss of life, or damage to property in the project site. The potential for ground rupture during an earthquake is limited to areas within 250 feet of a fault. Therefore, this impact is considered less than significant. No mitigation is required.

8.2.3.3 Impact Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils

The project site is underlain almost exclusively by unconsolidated sediments, including Bay Mud. Bay Mud exhibits high compressibility and low shear strength. However, the site levees have been in place since the 1850s, and the site has not experienced landslides, lateral spreading, subsidence, liquefaction, or collapse. The implementation of the project would not increase the risk of any of these hazards.

Repair and maintenance of existing levees would include fill placement and construction on the levees. These activities may impose excess loads on the unstable substrate, potentially leading to subsidence and/or differential settlement. Localized loading (e.g., as a result of levee construction) would likely increase substrate shear stresses and has the potential to result in levee failure if design or construction is inadequate or inappropriate. However, structures would be engineered to withstand seismic events to the extent practicable, and these structures would not be located in an area that would result in the increased exposure of people to adverse effects. Therefore, this impact is considered less than significant. No mitigation is required.

8.2.3.4 Impact Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils

Soils at the project site are expansive soils (Reyes clay, Reyes silty clay, and Bay Mud). These soils exhibit shrink-swell behavior (Soil Conservation Service 1972, 1985). Although these soils are expansive, structures would be constructed in accordance with applicable engineering standards and building codes. Thus, shrink-swell behavior would not pose a risk of personal injury, loss of life, or damage to property in the restored tidal marshlands. Although the expansive soils have the potential to affect levees, the levees at the site are not used for flood control; therefore, this impact is considered less than significant. No mitigation is required.

8.2.3.5 Impact Geo-6: Flooding of the Project Area as a Result of Tsunamis

Based on modeling by Garcia and Houston (1975), performed for sites near the project site that are also connected to the bay, both the 100-year tsunami and the 500-year tsunami would have the potential to inundate the project site. The 100-year tsunami would likely produce runups in San Pablo Bay ranging from 3.3 feet along the shore of Tubbs Island (Sonoma Creek and south of SR 37) to 4.1 feet in portions of Novato Creek. Likely runups for the 500-year tsunami range from 3.7 feet at Tubbs Island to 6.3 feet on Novato Creek. Similar runup ranges could be expected at the project site.

Because the final elevation of the marsh and associated levees is undetermined at this time, the effect of a tsunami is uncertain. However, it is known that the gradients at the site would be very gentle, thus increasing the effect of any tsunami that can exceed the height of the outer levees, resulting in inundation of the project site. Because the site consists of tidal marsh and managed ponds, inundation of the project area is not of concern. Under Salinity Reduction Option 1A, no existing levees would be removed; thus there would be no change in the potential for tidal inundation.

The salt ponds themselves would continue to be open space during the salinity reduction phase. Consequently, risk of personal injury or loss of life as a result of tsunami inundation would not be exacerbated by the project and would not represent an increase compared with existing conditions. Recreational users and operations and maintenance staff would be protected from all but proximally generated events by the NOAA's tsunami warning system. This impact is considered less than significant. No mitigation is required.

8.2.3.6 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion increases as the pond water level increases. Higher water levels in managed ponds (i.e., Pond 1, 1A, 2, 6, 6A, 7, 7A, and 8) would result in windblown waves and potential overtopping during significant storm events. Both of these factors would increase the rate of levee erosion. This impact is considered significant. Implementation of Mitigation Measure Geo-1 would reduce this impact to a less-than-significant level.

Mitigation Measure Geo-1: Maintain Water Level 2 Feet below Levee Crest

The project sponsors will control pond water height through active management of unbreached ponds, reducing the potential for pond erosion.

8.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Impacts Geo-3, Geo-4, Geo-6, and Geo-7. Impacts Geo-1, Geo-5, and Geo-7 are slightly different and are described below. Additional impacts are also described below.

8.2.4.1 Impact Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking

Because the levee for Pond 3 would be breached intentionally under this option, potential levee failures are of less concern for this pond than under Salinity Reduction Option 1A. This impact is considered less than significant. No mitigation is required.

8.2.4.2 Impact Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils

Again, the levee for Pond 3 would be breached intentionally under this option; potential levee failures are of less concern for this pond than under Salinity Reduction Option 1A. While the expansive soils have the potential to affect levees, the levees at the site are not used for flood control; therefore, this impact is considered less than significant. No mitigation is required.

8.2.4.3 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion increases as the pond water level increases. Higher water levels in managed ponds (i.e., Pond 1, 1A, 2, 6, 6A, 7, 7A, and 8) would result in windblown waves and potential overtopping during significant storm events. Both of these factors would increase the rate of levee erosion. However, ~~I~~in Pond 3, a breached pond, water levels are expected to be lower than historical levels because water in the ponds will equilibrate with the tides. This impact is considered significant. Implementation of Mitigation Measure Geo-1, "Maintain Water Level 2 Feet Below Levee Crest," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

8.2.4.4 Impact Geo-8: Potential Erosion as a Result of Increased Tidal Prism

Breaching of the existing Pond 3 levee under this option would result in an increase in the tidal prism (water volume and potentially velocity) entering and exiting Pond 3, potentially resulting in increased erosion adjacent to the breach. This erosion is intentional and consistent with the habitat restoration effort that would follow shortly after the salinity in Pond 3 is reduced to ambient conditions. If the~~is erosion~~ increased tidal prism leads to unintentional breaches, there is the potential for substantial erosion. This issue is addressed in Impact H-3, "Increased Risk of Property Damage, Injury, or Death as a Result of Flooding," in Chapter 3, "Hydrology."

This impact is considered significant. Implementation of Mitigation Measure H-1, "Repair Unintended Levee Breaches," would reduce this impact to a less-than-significant level. This measure is described in Chapter 3, "Hydrology."

8.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts Geo-1, Geo-3, Geo-4, Geo-5, Geo-6, Geo-7, and Geo-8) are nearly the same as those under Salinity Reduction Option 1B. Salinity Reduction Option 1C would also include the breaching of Pond 4/5, resulting in the potential for additional erosion. However, the impact conclusions and mitigation for this option are the same as for Salinity Reduction Option 1B.

8.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Impacts Geo-1, Geo-3, Geo-4, Geo-5, Geo-6, and Geo-7) are nearly the same as those under Salinity Reduction Option 1A, except that construction associated with the water control structures would be more extensive. Because all such construction would be completed in accordance with applicable codes, no additional impacts are anticipated. All impacts remain less than significant, and no mitigation is required.

8.2.7 Water Delivery Option

Potential impacts associated with the construction of the Water Delivery Option differ from those associated with the salinity reduction options. Impacts Geo-1, Geo-2, Geo-3, Geo-7, and Geo-8 are not applicable to the Water Delivery Option because they are specific to levees and conditions in the ponds. Potential impacts Geo-4, Geo-5, and Geo-6 are similar to the impacts associated with the salinity reduction options; the differences are described below. In addition, the Water Delivery Option potentially results in two other impacts (Geo-9 and Geo-10), as described below.

8.2.7.1 Impact Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils

Water Delivery Project Component (Sonoma Pipeline)

As discussed above in "Project Setting," the soils along sections of the Sonoma Pipeline corridor are susceptible to liquefaction or failure during a seismic event. However, no structures other than the pipeline would be constructed on such soils. Operation of the pipeline would not affect ground stability. This impact is

considered significant. Implementation of Mitigation Measure Geo-2 would reduce this impact to a less-than-significant level.

Mitigation Measure Geo-2: Remove Unstable or Expansive Soils and Backfill with Engineered Fill

In the event that unstable geologic units or soils are encountered during pipeline construction, the contractor will remove such materials and will backfill the pipeline section with engineered fill meeting the required specifications for compaction and shear strength.

Water Delivery Project Component (Napa Pipeline)

Similar to the Sonoma Pipeline, segments of the Napa Pipeline have soils that are susceptible to liquefaction or failure during a seismic event. This impact is considered significant. Implementation of Mitigation Measure Geo-2, "Remove Unstable or Expansive Soils and Backfill with Engineered Fill," would reduce this impact to a less-than-significant level. This measure is described above.

Water Delivery Project Component (CAC Pipeline)

Similar to the Sonoma and Napa Pipeline, segments of the CAC Pipeline have soils that are susceptible to liquefaction or failure during a seismic event. This impact is considered significant. Implementation of Mitigation Measure Geo-2, "Remove Unstable or Expansive Soils and Backfill with Engineered Fill," would reduce this impact to a less-than-significant level. This measure is described above.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined; however, impacts relative to unstable geologic units and soils for the potential future pipelines could be generally similar in nature and scope to those described above for the currently proposed pipelines. This impact is considered significant. Implementation of Mitigation Measure Geo-2, "Remove Unstable or Expansive Soils and Backfill with Engineered Fill," would reduce this impact to a less-than-significant level. This measure is described above.

8.2.7.2 Impact Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils

Water Delivery Project Component

Expansive soils could be encountered during trenching and construction of the Sonoma Pipeline. This impact is considered significant. Implementation of Mitigation Measure Geo-2, "Remove Unstable or Expansive Soils and Backfill with Engineered Fill," would reduce this impact to a less-than-significant level. This measure is described under Impact Geo-4 above.

Water Delivery Program Component

Impacts relative to expansive soils for the potential future pipelines would be similar in nature and scope to those described above for the currently proposed pipelines. This impact is considered significant. Implementation of Mitigation Measure Geo-2, "Remove Unstable or Expansive Soils and Backfill with Engineered Fill," would reduce this impact to less-than-significant level. This measure is described under Impact Geo-4 above.

8.2.7.3 Impact Geo-9: Exposure of People or Structures to Potential Adverse Effects as a Result of Fault Rupture, Ground Shaking, or Ground Failure

Water Delivery Project Component (Sonoma Pipeline)

Because of the passive nature of operation of the Sonoma Pipeline, the short-term nature of construction activities along the corridor, and the lack of people or structures in proximity to the project, construction and operation of the Sonoma Pipeline would not expose people or structures to potential adverse impacts (including the risk of loss, injury, or death). In the event that a seismic event were to damage the pipeline, shutoff valves would prevent flooding from reclaimed water, and no potential significant impacts on people or structures are expected relative to exposure to reclaimed water. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

The Napa Pipeline would have similar construction and operation impacts as those described above for the Sonoma Pipeline. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline)

The CAC Pipeline would have construction and operational impacts similar to those described above for the Sonoma Pipeline. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined. Impacts related to fault rupture, ground shaking, and ground failure for the potential future pipelines would be comparable to those for the Project Component, except that they would be experienced over a larger area. Construction and operation of the pipelines would be similar to that of the Project Component, and recycled water pipeline breakage would not be expected to threaten people or structures over the larger program area. This impact is considered less than significant. No mitigation is required.

8.2.7.4 Impact Geo-10: Substantial Soil Erosion or Loss of Topsoil

Water Delivery Project Component (Sonoma Pipeline)

Trenching and construction activities for the Sonoma Pipeline could cause some loss of topsoil on and near the pipeline corridors. However, such activities would be carried out in compliance with applicable regulations and standards related to erosion control during construction projects. Implementation of standard on-site BMPs (e.g., sandbags, silt screens, watering of dry exposed soils) would minimize soil erosion or loss of topsoil. Operation of the Sonoma Pipeline would not contribute to significant erosion or loss of topsoil because the pipeline would be buried below grade, and water delivered under this option would be applied to the salt ponds in a manner that would not cause or contribute to soil erosion at the project site. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

The Napa Pipeline would be constructed in a similar fashion to the Sonoma Pipeline, and would have similar soil erosion impacts. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline)

The CAC Pipeline would be constructed in a similar fashion to the Sonoma Pipeline, and would have similar soil erosion impacts. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined; however, the construction and operation of each of the potential future pipelines could have erosion impacts similar in scale to those for the currently proposed pipelines. The potential future pipelines from the surrounding WWTPs would not be expected to cause or contribute to substantial soil erosion with implementation of standard construction practices, similar to those of the Sonoma, CAC, and Napa Pipelines. This impact is considered less than significant. No mitigation is required.

8.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 (Geo-1, Geo-4, Geo-5, Geo-6, Geo-7, and Geo-8) are similar to impacts under Salinity Reduction Option 1C because exterior levees would be breached in both cases. However, more levees would be breached, and the breaches would be wider under Habitat Restoration Option 1 than under Salinity Reduction Option 1B or 1C. The key differences between the impacts under the two options are described below.

8.2.8.1 Impact Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking

As discussed previously, the project site is likely to undergo strong ground shaking from a major earthquake within the next 30 years. Smaller seismic events are also likely to occur during this timeframe, and the site is located on unconsolidated sediments, which are known to amplify and prolong seismic ground shaking. Levees, water control structures, utilities, and recreational facilities are thus at risk of damage from strong seismic ground shaking.

Under this option, repairs and maintenance of existing levees and water conveyance/control structures would be performed as required to maintain the integrity of these structures. In addition, new recreational facilities would be engineered to withstand seismic events to the extent practicable. Because of the repairs, proper engineering of new facilities, and ongoing maintenance, this impact is considered less than significant. No mitigation is required.

8.2.8.2 Impact Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils

The project site is underlain almost exclusively by unconsolidated sediments, including Bay Mud. Bay Mud exhibits high compressibility and low shear strength. However, the site levees have been in place since the 1850s, and the site has not experienced landslides, lateral spreading, subsidence, liquefaction, or collapse. The implementation of Habitat Restoration Option 1 would not increase the risk of any of these hazards.

Repair and maintenance of existing levees would include fill placement and construction on the levees. These activities may impose excess loads on the unstable substrate, potentially leading to subsidence and/or differential settlement. Localized loading (e.g., as a result of levee construction) would likely increase substrate shear stresses and has the potential to result in levee failure if design or construction is inadequate or inappropriate. However, these structures would be engineered to withstand seismic events to the extent practicable. New recreational facilities would also be designed in accordance with applicable codes. These structures would be engineered to be seismically resistant. Therefore, this impact is considered less than significant. No mitigation is required.

8.2.8.3 Impact Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils

Soils at the project site are expansive, exhibiting shrink-swell behavior. Although these soils are expansive, any new structures such as recreational facilities would be constructed in accordance with applicable engineering standards and building codes. Thus, shrink-swell behavior would not pose a risk of personal injury, loss of life, or damage to property in the restored tidal marshlands. Although the expansive soils have the potential to affect levees, the levees at the site are not used for flood control. Therefore, this impact is considered less than significant. No mitigation is required.

8.2.8.4 Impact Geo-6: Flooding of the Project Area as a Result of Tsunamis

As described earlier, based on modeling by Garcia and Houston (1975), the study area could potentially be inundated by tsunamis. Because the final elevation of the marsh and associated levees is undetermined at this time, the effect of a tsunami is uncertain. However, it is known that the gradients at the site would be very gentle, thus increasing the effect of any tsunami. Because the site consists

of tidal marsh and managed ponds, inundation of the project area is not of concern for the environment.

The existing levees are not designed as flood protection levees; thus, removal or breaching of any of the levees would not affect the risk of flooding of the project area by a tsunami. The project site would remain a recreational use area during habitat restoration. Consequently, risk of personal injury or loss of life as a result of tsunami inundation would not be increased by Habitat Restoration Option 1. Recreational users and operations and maintenance staff would be protected from all but proximally generated events by the NOAA's tsunami warning system. This impact is considered less than significant. No mitigation is required.

8.2.8.5 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion increases as the water level in the ponds increases. Higher water levels in the ponds retained as ponds either in the interim or in the long term would result in larger, more powerful waves, as well as the potential for overtopping during significant storm events. Both of these factors would increase the rate of levee erosion. This impact is considered significant. Implementation of Mitigation Measure Geo-1, "Maintain Water Level 2 Feet below Levee Crest," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

8.2.8.6 Impact Geo-8: Potential Erosion as a Result of Increased Tidal Prism

Under Habitat Restoration Option 1, three ponds (Ponds 3 and 4/5) would be opened to substantial tidal action through levee breaches. Levee breaches for habitat restoration would be more extensive than levee breaches required during desalination. Some of these levee breaches would be located along the Napa River, and others would be located along the sloughs. As the river and sloughs widen to historical widths, both accreted marsh and existing levees may be subject to erosion.

Breaching of the existing levees would result in an increase in the tidal prism, potentially resulting in increased erosion in the nearby sloughs and along the Napa River. Depending on the increase in tidal volume, the existing sloughs could both deepen and widen. As the tidal prism increases, erosion of the sides and substrates of the interior and exterior sides of levees, including existing marsh slough margins, would increase. Finally, with breached levees, pond bottoms could also be subject to erosion.

This impact is considered significant. Implementation of Mitigation Measures H-1, "Repair Unintended Levee Breaches," H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," and H-4, "Evaluate Susceptibility

of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed," would reduce this impact to a less-than-significant level. These measures are described in Chapter 3, "Hydrology."

8.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

More levees would be breached under Habitat Restoration Option 2 than under Habitat Restoration Option 1. The number of ponds opened to substantial tidal prism is greatest in Habitat Restoration Option 2. Impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Impacts Geo-1, Geo-3, Geo-4, Geo-5, and Geo-6. Impacts Geo-7 and Geo-8 are slightly different and are described below.

8.2.9.1 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion from excess water height in the ponds retained as ponds is also significant for Habitat Restoration Option 2, although fewer ponds would be retained as ponds under this option. This impact is considered significant. Implementation of Mitigation Measure Geo-1, "Maintain Water Level 2 Feet below Levee Crest," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

8.2.9.2 Impact Geo-8: Potential Erosion as a Result of Increased Tidal Prism

Under Habitat Restoration Option 2, five ponds and part of one pond (Ponds 3, 4/5, and 6/6A, and the eastern half of Pond 2) would be opened to substantial tidal action through levee breaches. Breaching of the existing levees would result in an increase in the tidal prism. The resulting tidal prism is the largest encountered in any of the options.

The increase in tidal prism could result in increased erosion in the nearby sloughs and along the Napa River. The existing sloughs would likely both deepen and widen. As the tidal prism increases, erosion of the sides and substrates of the interior and exterior sides of levees, including existing marsh slough margins, could also increase. Finally, with breached levees, pond bottoms could also be subject to erosion.

This impact is considered significant. Implementation of Mitigation Measures H-1, "Repair Unintended Levee Breaches," H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," and H-4, "Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed,"

would reduce this impact to a less-than-significant level. These measures are described in Chapter 3, "Hydrology."

8.2.10 Habitat Restoration Option 3: Pond Emphasis

Fewer ponds would be opened to substantial tidal action, and therefore fewer levee breaches would be required under Habitat Restoration Option 3 than under Habitat Restoration Option 1. Impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Impacts Geo-1, Geo-3, Geo-4, Geo-5, and Geo-6. Impacts Geo-7 and Geo-8 are slightly different and are described below.

8.2.10.1 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion from excess water height in the ponds retained as ponds is potentially significant for Habitat Restoration Option 3, because all but two ponds would be retained as ponds under this option. This impact is considered significant. Implementation of Mitigation Measure Geo-1, "Maintain Water Level 2 Feet below Levee Crest," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

8.2.10.2 Impact Geo-8: Potential Erosion as a Result of Increased Tidal Prism

Under Habitat Restoration Option 3, only two ponds (Ponds 3 and 4) would be opened to substantial tidal action through levee breaches. Breaching of the existing levees would result in an increase in the tidal prism. The resulting tidal prism would be the smallest encountered in any of the habitat restoration options.

The increase in tidal prism could result in increased erosion in the nearby sloughs and along the Napa River. The existing sloughs could both deepen and widen, although the degree of erosion would likely be less than for any of the other habitat restoration options. As the tidal prism increases, erosion of the sides and substrates of the interior and exterior sides of levees, including existing marsh slough margins, could also increase. Finally, with breached levees, pond bottoms could also be subject to erosion.

This impact is considered significant. Implementation of Mitigation Measures H-1, "Repair Unintended Levee Breaches," H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," and H-4, "Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed," would reduce this impact to a less-than-significant level. These measures are described in Chapter 3, "Hydrology."

8.2.11 Habitat Restoration Option 4: Accelerated Restoration

Under Habitat Restoration Option 4, various design features have been added that would accelerate marsh evolution compared with Habitat Restoration Option 1. Impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Impacts Geo-1, Geo-3, Geo-5, and Geo-6. Impacts Geo-4, Geo-7, and Geo-8 are slightly different and are described below.

8.2.11.1 Impact Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils

Repair and maintenance of existing levees as well as construction of interior berms and peninsulas would include fill placement and construction on and adjacent to the levees. These activities may impose excess loads on the unstable soil substrate, potentially leading to subsidence and/or differential settlement. Localized loading (e.g., as a result of levee construction) would likely increase substrate shear stresses and has the potential to result in levee failure if design or construction is inadequate or inappropriate. However, the levees and interior berms would be engineered to withstand seismic events to the extent practicable. New recreational facilities would also be designed in accordance with applicable codes. These structures would be engineered to be seismically resistant. Therefore, this impact is considered less than significant. No mitigation is required.

8.2.11.2 Impact Geo-7: Potential Erosion as a Result of Excess Pond Water Height

The potential for levee erosion from excess water height in the ponds retained as ponds is also significant for Habitat Restoration Option 4, because Ponds 6, 6A, 7, 7A, and 8 would be retained as ponds under this option. This impact is considered significant. Implementation of Mitigation Measure Geo-1, "Maintain Water Level 2 Feet below Levee Crest," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

8.2.11.3 Impact Geo-8: Potential Erosion as a Result of Increased Tidal Prism

Under Habitat Restoration Option 4, three ponds (Ponds 3 and 4/5) would be opened to substantial tidal action through levee breaches. Breaching of the existing levees would result in an increase in the tidal prism. However, the increase in tidal prism would be reduced by importing sediment to create a 100-

acre fill area and increasing the number of starter channels and berms. The duration of the increased tidal prism would be reduced because the added design features included in this option would accelerate the formation of new marsh.

The increase in tidal prism could result in increased erosion in the nearby sloughs and along the Napa River. The existing sloughs could both deepen and widen, although the degree of lateral erosion may be lessened by pre-dredging the slough channels. As the tidal prism increases, erosion of the sides and substrates of the interior and exterior sides of levees, including existing marsh slough margins, could also increase. Finally, with breached levees, pond bottoms could also be subject to erosion.

This impact is considered significant. Implementation of Mitigation Measures H-1, "Repair Unintended Levee Breaches," H-3, "Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge," and H-4, "Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed," would reduce this impact to a less-than-significant level. These measures are described in Chapter 3, "Hydrology."

Chapter 9

Hazards and Hazardous Materials

9.1 Environmental Setting

9.1.1 Introduction

This chapter describes the hazards and hazardous materials in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project.

Currently, hazards in the project area are limited to four classes of potential hazards: seismic events, floods, contaminated soil and groundwater, and uncontrolled releases of brines contained in the ponds. Seismic risks are discussed in detail in Chapter 8, "Geology and Soils." Flooding can occur in the project area, as shown by the 1998 Napa River flooding. Hazards related to flood events are discussed in Chapter 3, "Hydrology." Because flooding and seismic hazards have been discussed at length in Chapters 3 and 8, respectively, they are not discussed here.

This chapter addresses potential hazards associated with soil and/or groundwater contamination, other potential human health hazards posed by construction and operations at the site, and uncontrolled releases of brine. Pond 7 contains waste materials, or "bittern," left over after table salt (sodium chloride) was harvested. Bittern has been shown in laboratory studies to have toxic effects on aquatic life (S.R. Hansen and Associates 1993). Uncontrolled releases of highly saline brine and bittern could occur as a result of levee failure. Chapter 4, "Water Quality," provides a more detailed discussion.

The pH of the brine in Pond 8 has dropped to as low as 2.2, based on readings collected by DFG (Huffman pers. comm.). A waste material with a pH of 2.0 or below is classified as a hazardous waste because of the characteristic of corrosivity. If the pH in Pond 8 were to drop below 2.0 at any point during the project, the brine in the pond would be considered corrosive. If the brine were removed and/or declared a waste, it would then be classified as a hazardous waste. As of January 2004, the pH in Pond 8 was normal as a result of the addition of the water control structures.

9.1.2 Regulatory Setting

In California, hazardous materials and hazardous wastes are regulated extensively under federal, state, and local laws and regulations. Laws and regulations pertaining to hazardous materials and wastes are designed to protect human health and the environment. Federal regulations form the minimum thresholds; state and local laws and regulations may be more stringent than federal standards. State and local agencies are responsible for implementing most of the requirements of these laws and regulations. For the purposes of this discussion, the applicable laws and regulations address: (1) hazardous materials transportation; (2) hazardous materials and waste management; and (3) human health protection. In addition to any brines that are defined as hazardous materials or waste under existing regulations, other brines may require special management to ensure protection of human health and the environment.

9.1.2.1 Federal

Hazardous materials, hazardous substances, and hazardous wastes are all regulated under federal law. *Hazardous materials* are defined as "materials that may pose an unreasonable risk to health, safety, and property when transported in commerce" (49 CFR 171.8). Hazardous materials are listed in 49 CFR 172.101, Appendix A. Hazardous materials are regulated by the U.S. Department of Transportation (DOT) and require special handling, packaging, placarding, and manifesting of hazardous materials cargoes. Hazardous material transportation requirements are designed to ensure safe movement of hazardous materials and to ensure that sufficient information is immediately available should an accident occur. DOT regulates hazardous materials transport by truck and rail through the Hazardous Materials Transportation Act (HMTA). Day-to-day management of hazardous materials is governed by various laws, including the Superfund Amendments and Reauthorization Act (SARA) and HMTA. These laws define the requirements for storage of hazardous materials, safe handling practices, and employee training.

Hazardous substances are a subclass of hazardous materials. They are regulated under the CWA; the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as "Superfund"); and SARA. Releases of hazardous substances above certain thresholds may create a threat to human health or the environment. Hazardous wastes are included on the list of hazardous substances. Hazardous wastes, although included in the definition of hazardous materials and hazardous substances, are regulated separately under the Resource Conservation and Recovery Act (RCRA) and Hazardous and Solid Waste Amendments of 1984 (amendments to RCRA).

The statutory definition of *hazardous waste* is those wastes classified as ignitable, corrosive, reactive, or toxic. A material that has a pH value of less than 2 is considered corrosive. A material can be classified as a hazardous waste only after it is generated, i.e., after it has been designated as a waste by its owner. This means that the brines and bittern in the project area could not be classified

as hazardous wastes until they have been designated wastes by their owners (i.e., DFG). Similarly, any contaminated soils, water, or sediments in place in the project area could not be classified as hazardous waste unless they are removed from the ground (once removed, they are considered to have been "generated"). RCRA regulates hazardous waste from the time that the waste is generated through its management, storage, transport, and treatment, until its final disposal. EPA is responsible for implementing this law and can delegate its responsibility under the law to the states.

9.1.2.2 State

California law defines a *hazardous material* as any material that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may pose a present or potential hazard to human health and safety or to the environment if released in the workplace or the environment (California Health and Safety Code Section 25501). A *hazardous waste* is defined as a discarded material of any form (e.g., solid, liquid, gas) that may pose a present or potential hazard to human health and safety or to the environment when improperly treated, stored, transported, or disposed of, or otherwise managed (California Health and Safety Code Section 25117). Hazardous wastes are included in the definition of hazardous materials. Hazardous wastes are regulated under Chapter 6.5 of the state Hazardous Waste Control Health and Safety Law and Title 22 of the California Code of Regulations.

In California, ~~the California Environmental Protection Agency (~~Cal/EPA~~)~~ Department of Toxic Substances Control has been authorized by EPA to administer the RCRA program. California's RCRA program is more stringent than the federal program. ~~California has laws and regulations that cover the generation and storage of hazardous waste.~~ Some of ~~these~~ California's laws and regulations reinforce the federal regulations, and others impose additional requirements for the transportation, storage, and clean-up of hazardous waste.

Handling and storage of fuels, flammable materials, and common construction-related hazardous materials are governed by California Occupational Safety and Health Administration (Cal/OSHA) standards for storage and fire protection.

9.1.2.3 Local

Local regulation and enforcement of hazardous materials/wastes laws and regulations is through the local county health/hazardous materials departments, also known as certified unified program agencies (CUPAs). CUPAs provide a central permitting and regulatory agency for permits, reporting, and compliance enforcement. The project area encompasses portions of three counties (Napa, Sonoma, and Solano). Thus, local regulations from all of these counties may apply.

9.1.3 Regional Setting

The area surrounding the project site is predominantly agricultural, consisting of vineyards and some grazing areas. One duck club, the Can Duck Club, is located on the project property (at Pond 2); another private duck club is on private property immediately northeast of Ponds 6 and 6A. The former Mare Island Naval Reservation is directly southeast, and Skaggs Island (also a former naval base) is west of the project site. A portion of the property is bounded by SR 37 to the south. The cities of Vallejo and Napa are southeast and northeast of the project area, respectively. The former crystallizer ponds used by Cargill are directly east of Pond 8 on the other side of the Napa River. Residences are located along the Napa River on Edgerley Island immediately east of Pond 8 (Figure 2-2).

Both Mare Island and Skaggs Island are known to have had hazardous substance and petroleum compound releases. Contamination identified at these sites is being investigated and remediated under oversight by EPA and Cal/EPA. Other, smaller hazardous substance release sites are likely to be present in the region; however, no such sites have been identified in the immediate project area. Potential sources of hazardous substance releases in the project area consist of pesticide use at the agricultural areas, lead from birdshot used by the duck clubs, and pesticides associated with former mosquito abatement activities. No known hazardous materials have been identified in the residential areas surrounding the project site.

With regard to the regional setting for the Water Delivery Option, the north bay region is characterized primarily by extensive agricultural and rural land (approximately 51% of the area) and wildlife area (approximately 20% of the area). Other uses include residential, commercial and light industry, public facilities, open space and recreation, and heavy industry. In general, the north bay region does not have any regional hazardous waste contamination problems; however, there are numerous individual known and potential contamination sites, particularly in the more urbanized areas. Such sites include, but are not limited to, gas stations and other facilities with underground or aboveground storage tanks; auto salvage yards; industrial and manufacturing facilities; solid waste management facilities; transportation facilities (vehicular, railroad, marine, and aircraft); and various commercial uses.

9.1.4 Project Setting

No known, documented releases of hazardous materials or substances have occurred within the project area (Wyckoff pers. comm.). The presence of highly concentrated brines and bittern in ponds in the project area poses a potential risk to the environment if these materials are released in an uncontrolled manner. DFG and Cargill have not designated materials on-site as wastes. Continuing deterioration of the levees as a result of wind and wave erosion and scouring could result in a levee breach in the future, leading to an uncontrolled release of

highly saline brines and bittern. As noted in Chapter 7, "Biological Resources—Aquatic Resources," excess salinity and bittern can have lethal effects on fish.

During the summer months, high evaporation rates lead to a reduction in the volume of water in the ponds. As a result, salts (including bittern salts) may precipitate in the higher salinity ponds. The precipitated salts tend to form a hard crust, reducing the potential for the wind to blow dust and salt from the ponds.

9.1.4.1 Historical Sampling and Analysis

Historical sampling activities in the area of the ponds have been limited to water quality parameters, primarily salinity and pH. Salinity has ranged from a low of 0 to a high of 447 ppt, and pH has ranged from 2.2 to 9.1. A more detailed discussion is provided in Chapter 4, "Water Quality."

A records search of hazardous waste sites and activities was conducted to help characterize the potential for contamination to exist on or near the proposed construction routes for the Sonoma, CAC, and Napa Pipelines. The results found that very few sites are known to occur along the subject routes (VISTA Information Solutions 2002). Such is not considered unusual given the undeveloped rural nature of much of the area. The results of the records search are presented under "Water Delivery Project Component Area" below.

9.1.4.2 Known Contamination

Napa River Unit

In an effort to characterize the potential impacts of desalination on the receiving waters (i.e., flushing of the brines into Napa Slough, the Napa River, and/or San Pablo Bay), an extensive water- and sediment-testing program was conducted in October and November 2001 (HydroScience Engineers 2002). The sampling program is described in detail in Chapter 4, "Water Quality."

The results of the testing indicate that organic chemicals (including pesticides, PCBs, dioxins, and semivolatile organic compounds) are encountered only rarely in the project area. When detected, they are present in concentrations well below any hazardous materials thresholds. Detected concentrations of metals were at or near background levels (i.e., comparable to Napa River and Napa Slough sediment concentrations) and also well below any hazardous waste thresholds. Slightly higher concentrations of metals were identified in the ponds with more concentrated brines; this is the result of naturally occurring trace levels of heavy metals being concentrated during the salt-making process.

Water Delivery Project Component Area

As indicated above, a hazardous materials database search was conducted for the construction areas of the two pipelines currently proposed under the Water Delivery Option. Lists of contaminated sites maintained by various local, state, and federal agencies were included in the database review (VISTA Information Solutions 2002). The following summarizes the results of the database review completed for the construction areas of each pipeline.

Sonoma Pipeline

Based on the results of the database review, there were three records found within 0.125 mile of the proposed Sonoma Pipeline alignment (i.e., within a 0.25-mile-wide corridor extending 0.125 mile on each side of the proposed alignment). These sites are recorded as having underground storage tanks (USTs). Two of the sites had leaking underground storage tanks (LUSTs); however, the records are marked as "case closed." There is one site listed within 0.125–0.25 mile of the pipeline alignment. This site contained an UST that has been removed and two LUSTs. The record shows that the two LUSTs have been listed as "case closed." Five records were found located within 0.125–0.25 mile of the pipeline alignment. Of these, one is a USGS water well, and the remaining four contained LUSTs that all have been marked as "case closed."

Nine records, including three duplicates (i.e., only six unique records), in the results of a 2-mile distance search (i.e., extending 1 mile in each direction from the pipeline corridor centerline) were not specifically mapped; however, based on the addresses and descriptions indicated for the subject records, eight of the nine subject records were eliminated from possibly occurring at or near the Sonoma Pipeline.

Two of the eight records are both indicated as being "Caltrans, 1684 Union, Napa." It is unclear whether "Union" refers to a street or to a specific union location. However, neither is near the pipeline route. There are also no Caltrans facilities at or near the pipeline route. Two other records are both indicated as being "Clos Pegase Reservoir, Napa." There are no such reservoirs at or near the pipeline route. One other record is indicated as being a UST at "Walsh Vineyards, 2440 Duhig Road, Napa." The pipeline route is more than 0.25 mile south of Duhig Road; the explanation for the subject record indicates that it was a tank closure and no abatement action was required (implying that no notable contamination occurred). One record is indicated as "Korbel Winery." Korbel Winery is located in Guerneville, California, which is not located near the Sonoma Pipeline. The remaining two records are simply indicated as "Howard Nunn, Napa, CA" with no description or explanation of any sort of hazardous materials/waste release or contamination. The subject records are found on the North Bay Toxics List published in 1994, but on no other federal, state, or local lists.

One other record is listed as "SRGC Class II WMU." This facility is categorized as a solid waste site that has had no violations. Since it is uncertain whether this unmapped record is within 2 miles of the proposed alignment, it is included in the existing conditions.

Overall, there was no evidence to suggest that contamination occurs adjacent to the proposed pipeline route.

Napa Pipeline

Segment 1 of the Napa Pipeline has been evaluated previously for hazardous materials along the alignments. Segment 2 is included within the 1-mile radius of the database search for the Sonoma Pipeline. As described above under the Sonoma Pipeline, there was no evidence to suggest that contamination occurs adjacent to the proposed pipeline route.

CAC Pipeline

Based on the results of the database review, there are 26 mapped records of sites within 0.125 mile of the CAC Pipeline alignment. However, 13 of these records are along an area where no construction would occur. Additionally, 17 records, including nine duplicates (i.e., only eight unique records), of listed sites within a mile of the alignment were not specifically mapped because address information was incomplete.

Several records listed as a result of the Sonoma database review also were listed in the search for the CAC Pipeline. "Clos Pegase Reservoir, Napa" was listed; however, there are no reservoirs along the CAC Pipeline route. "Mr. Howard Nunn, Napa, CA" was also listed, but as discussed previously for the Sonoma Pipeline, there is no explanation of hazardous materials/waste release or contamination. "Don Pridmore Son, Napa, CA," while not found in the CAC Pipeline search, is a similar record to the "Mr. Howard Nunn" record in that there is no evidence of contamination. The record is listed as having a registered aboveground storage tank but is not listed on any local, state, or federal lists. "Caltrans, 1684 Union, Napa, CA" is listed on a state index of properties with hazardous waste. Again, no such address was located in the vicinity of the pipeline. ~~It is unclear whether "Union" refers to a street or to a specific union station. However, neither is near the pipeline route.~~

Of the remaining four unmapped records, two were listed as "case closed." Because it is uncertain whether the last two unmapped records are within 0.125 mile of the proposed alignment, they are included in the existing conditions. Therefore, there are a total of 15 sites (13 mapped, two unmapped) along the CAC alignment. Of the 15 records, the most common types of sites recorded are LUST sites. Other types of sites include

- sites on the North Bay Toxic List, the state index of properties with hazardous waste, the EPA Facility Index System, the state equivalent Comprehensive Environmental Response Compensation and Liability Information System list, or the EPA/state spills list;
- water wells;
- state-registered aboveground storage tanks;
- solid waste landfills, incinerators, or transfer stations;
- RCRA-registered small or large generators of hazardous waste; and

- sites with RCRA violation/enforcement action.

9.2 Environmental Impacts and Mitigation Measures

9.2.1 Methodology and Significance Criteria

Potential for ecological impacts were assessed by estimating the quantity of hazardous materials brought into the project site as a result of the project and any reductions in such materials resulting from the implementation of each option. The analysis assumes that construction activities in the project site would be conducted in accordance with existing laws and regulations pertaining to management of hazardous materials and wastes during construction.

Potential human health impacts attributable to the presence of hazardous materials and hazardous substances in the project ~~site~~ area were assessed by identifying potential receptors, exposure scenarios, and exposure pathways for each option. Based on the projected activities at the project site, the potential receptors are construction workers and nearby residents. The following exposure scenarios and exposure pathways have been identified:

- ~~*Exposure of construction workers to acutely hazardous (corrosive) brine and associated irritant dust during construction.* Workers could be exposed through direct (dermal) contact with the brine, through inhalation of vapors and dust, and/or through incidental ingestion of the dust.~~
- *Exposure of construction workers, the public, and the environment to hazardous materials such as fuel, oil, and explosives associated with construction.* Construction activities would include the transporting of construction materials, such as fuel and oils, and the use of explosives. During excavation under the Water Delivery Option, contaminated soil and/or groundwater could be encountered. Workers and the public could be exposed through direct contact or inhalation.
- *Exposure of nearby residents to irritant or contaminated dust during construction.* If dust is generated from the high-salinity and/or bittern ponds during construction, nearby residents could be exposed to irritant dust through inhalation. If any of the ~~pond sediments and/or~~ levee materials are contaminated, residents could be exposed to contaminated dust through inhalation.

Potential impacts on ecological receptors resulting from controlled releases of brines and bittern contemplated under the various project options are described in Chapter 7, "Biological Resources—Aquatic Resources."

Criteria based on the State CEQA Guidelines were used to determine the significance of hazards/hazardous waste–related impacts. The project would

have a significant impact on the environment related to hazards or hazardous waste if it would

- create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving release of hazardous materials into the environment;
- result in potential exposures exceeding human health criteria as defined in the National Contingency Plan (40 CFR 300 *et seq.*); or
- create a safety hazard because of proximity to an airport.

The potential hazardous materials impacts associated with the project are similar for all options, with the main differences being the intensity of each impact for each option. The impacts are generally associated with (1) construction activities (all construction activities involve the use and transportation of same hazardous materials and the potential generation of irritant dust), (2) levee breaching (use of explosives), and (3) potential accidental releases of bittern or high salinity brines.

9.2.2 No-Project Alternative

9.2.2.1 Impact Haz-1: Potential Release of Bittern or Highly Saline Brines into the Environment as a Result of Uncontrolled Levee Breaching

Under the No-Project Alternative, maintenance of the former salt ponds would be limited by available funding. Thus, levees would continue to deteriorate, and the salinity of the brines in the ponds closed to tidal influence would continue to increase over time. The brines would continue to concentrate because the ability to pump sufficient water into the ponds would be limited by both the funds available to pay for pumping costs and the continuing deterioration of the water conveyance infrastructure. In addition, the make-up water that is available also contains salts for a large portion of the year; therefore, adding make-up water, while minimizing salinity increases in the short term, would result in a long-term increase in salinity.

As a result, the risk of an accidental release of highly saline brines and/or bittern would continue to increase. The potential impact of such a release would depend on the amount and rate of material released, the time of year it is released (i.e., the species present and the water flow and salinity in the river and sloughs), and how quickly the breach could be repaired. As described in Chapter 2, "Site Description and Options," it is likely that at least a week of mobilization would be required before an emergency levee repair could be initiated. This impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

9.2.2.2 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Construction activities would be limited to the maintenance of the former salt ponds and could include limited levee repairs and repairs to the water conveyance infrastructure. These construction activities would result in fuels and lubricating oils as well as small quantities of maintenance-related chemicals being brought into the project area. Thus, there could be accidental releases of these materials into the environment. The quantities of materials brought into the project area would be relatively small, and any contractors working in the project area would be required to follow all applicable laws and regulations; therefore, this impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

9.2.2.3 Impact Haz-3: Potential Releases of Irritant Dust from Desiccated Ponds

Most of the ponds would eventually become dry salt flats during a portion of the year. The exception is Pond 7, the bittern pond. Bittern is hygroscopic (will attract water from the moisture in the air) and thus is unlikely to dry out completely. Observations of ponds that have dried out in the past indicate that the salts in the ponds form a hard crust that is resistant to dispersion by the wind (Huffman pers. comm.). Unless this crust is disturbed by significant human activity, such as construction, it is unlikely that desiccation of the ponds would result in the generation of irritant dust. Because construction activities are limited to minor maintenance under the No-Project Alternative, this impact is considered less than significant. For this reason, and because this project would result in no project being implemented, no mitigation is required.

9.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

9.2.3.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Salinity Reduction Option 1A include improvements to existing water conveyance structures, installation of new water conveyance and control structures, repairs and upgrades to existing levees, and long-term maintenance of levees and water conveyance/control structures for the upper ponds (i.e., the ponds with a long desalination period). Breaching of ~~interior~~ levees with explosives is discussed below.

Conventional construction activities would include transporting construction materials, such as fuels and oils, and the use of heavy machinery. Of particular concern are the construction activities required on the island ponds (Ponds 2, 3, 4/5, and 6/6A) because fuel and other hazardous materials associated with the operation of the machinery would have to be transported through the sloughs, increasing the potential for accidental releases of these materials into the environment. Although any contractors working in the project area would be required to follow all applicable laws and regulations, this impact is considered significant because of the ecological sensitivity of the area. Implementation of Mitigation Measure Haz-1 would reduce this impact to a less-than-significant level.

Improper handling, use, or disposal of hazardous materials and hazardous wastes could also result in unacceptable exposures of construction workers. All contractors would be required to comply with applicable laws and regulations pertaining to worker safety and health. However, this impact is considered significant. Implementation of Mitigation Measure Haz-1 would reduce this impact to a less-than-significant level.

Mitigation Measure Haz-1: Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation

Construction contractors working on the project will be required to provide their employees with enhanced spill prevention and response training, and will be required to have spill response equipment available at the job site, as directed by the project sponsors. Contractors will provide double containment for any hazardous materials or wastes at the job site. Contractors will be prepared to respond to any spill immediately and to fully contain spills in the project area, including any open-water areas.

9.2.3.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

Interior levee breaches for Ponds 4/5 and 6/6A would be accomplished using explosives. Improper handling, placement, or detonation of these explosives could result in residual chemicals being released into the environment. In addition, excessive charge sizes could result in larger breaches than desired, exacerbating releases into the environment. This impact is considered significant. Implementation of Mitigation Measure Haz-2 would reduce this impact to a less-than-significant level.

Mitigation Measure Haz-2: Employ Explosives Experts when Breaching Levees

Only trained experts will be allowed to transport, place, or detonate the explosive charges required for levee breaches. These experts shall be under direct supervision of the project sponsors, and may not be subcontracted as part of the overall construction effort. In addition, the experts retained to perform the explosives work shall be required to prepare a health and safety plan specifically addressing their work and demonstrating that there will be no residual explosive materials. This health and safety plan shall require review and approval before the start of the work by experts hired by the project sponsors.

9.2.3.3 Impact Haz-5: Potential Releases of Irritant Dust as a Result of Construction Activities

At ponds with existing salt crusts, construction activities may result in some of the salt crusts being pulverized by construction equipment. As a result, ~~both~~ on-site construction workers ~~and nearby residents~~ could be exposed to high levels of irritant dust. ~~Potential residential exposures are limited to work at and near Pond 8, where the prevailing winds could transport the dust to nearby residents.~~ This impact is considered significant. Implementation of Mitigation Measures Haz-3 and Haz-4 would reduce this impact to a less-than-significant level.

Mitigation Measure Haz-3: Develop and Implement a Health and Safety Plan

The project sponsors will ensure that a site-specific health and safety plan is developed and implemented by the contractor as part of contract specifications. At a minimum, the contractor's health and safety plan must show how the contractor will comply with the nuisance dust standard set by Cal/OSHA in the immediate work area and at the perimeter of the work area. The contractor will achieve compliance with the nuisance dust standard by taking preventive measures such as watering the disturbed areas or providing respirators. As described in Chapter 11, "Air Quality," the contractor will also be required to comply with most of the BAAQMD's BMPs for dust control.

Mitigation Measure Haz-4: Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8

To ensure that residents are protected from exposures to irritant dust while work proceeds in the vicinity of Pond 8, the contractor will perform perimeter monitoring to demonstrate compliance with the nuisance dust standard.

9.2.3.4 Impact Haz-6: Accidental Breaching of Exterior Levees on Highly Saline/Bittern Ponds as a Result of Construction Activities

As described for the No-Project Alternative, there is a potential for releases of highly saline brines and/or bittern into the environment. As part of Salinity Reduction Option 1A, all levees would be carefully inspected and repaired as necessary to ensure that they would maintain their integrity throughout the desalination period. In the unlikely event that the construction contractor accidentally causes an exterior levee breach at a pond containing highly saline brines or bittern, the contractor would immediately use on-site equipment to repair the breach. Because of the low probability of an accidental breach, the likely small breach size, and the ability to implement immediate repairs, this impact is considered less than significant. No mitigation is required.

9.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Impacts Haz-5 and Haz-6. Impacts Haz-2 and Haz-4 are slightly different and are described below.

9.2.4.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Because water control/conveyance structures are not required for Pond 3, conventional construction activities associated with Salinity Reduction Option 1B are less extensive and would occur in fewer areas than under Salinity Reduction Option 1A. Nonetheless, this impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.4.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

The potential impact associated with levee breaches is greater under Salinity Reduction Option 1B than under Salinity Reduction Option 1A. In addition to the interior levee breaches required under all salinity reduction options, Salinity

Reduction Option 1B requires an exterior levee breach at Pond 3. Implementation of Mitigation Measure Haz-2, "Employ Explosives Experts when Breaching Levees," would reduce this impact to a less-than-significant level. This mitigation measure is described under Salinity Reduction Option 1A.

9.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1A for Impacts Haz-5 and Haz-6. Impacts Haz-2 and Haz-4 are slightly different and are described below.

9.2.5.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Because water control/conveyance structures are not required for Ponds 3 and 4/5, conventional construction activities associated with Salinity Reduction Option 1C are less extensive and would occur in fewer areas than under Salinity Reduction Option 1A. Nonetheless, this impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.5.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

The potential impact associated with levee breaches is greater under Salinity Reduction Option 1C than under Salinity Reduction Options 1A and 2. In addition to the interior levee breaches required under all salinity reduction options, Salinity Reduction Option 1C requires exterior levee breaches at Ponds 3 and 4/5. Implementation of Mitigation Measure Haz-2, "Employ Explosives Experts when Breaching Levees," would reduce this impact to a less-than-significant level. This mitigation measure is described under Salinity Reduction Option 1A.

9.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts Haz-4, Haz-5, and Haz-6. Impact Haz-2 is slightly different and is described below.

9.2.6.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Salinity Reduction Option 2 are more extensive and would occur in more areas than under Salinity Reduction Option 1A. Thus, this impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.7 Water Delivery Option

9.2.7.1 Impact Haz-7: Hazard Resulting from the Routine Transport, Use, or Disposal of Hazardous Materials

Water Delivery Project Component (Sonoma Pipeline)

Operation of the Sonoma Pipeline would not involve the transport, use, or disposal of hazardous materials. Construction of the pipeline would not involve any notable use of hazardous materials; however, in the event that hazardous waste contamination is encountered during pipeline construction, the management of contaminated materials could include excavation and transport for off-site treatment/disposal at an acceptable facility.

As described in greater detail below in Sections 9.2.7.2 and 9.2.7.3, there is the potential for construction along the pipeline routes to encounter subsurface contamination; however, based on existing information, the potential for such contamination to be substantial (i.e., extensive and widespread) is considered to be relatively low. The transport and disposal of hazardous materials/waste would occur only if notable contamination is encountered and such management means are warranted, and would be accomplished in compliance with federal, state, and local safety requirements. In summary, development of the Sonoma Pipeline would not create a hazard through the routine transport, use, or disposal of

hazardous materials. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

The Napa Pipeline similarly would not involve the transport, use, or disposal of hazardous materials during pipeline operations and would not involve any notable use of hazardous materials during construction. The transport and disposal of hazardous materials would occur only if notable contamination is encountered, which is unlikely, as described later in the section. As described above, development of the Napa Pipeline would not create a hazard through the routine transport, use, or disposal of hazardous materials. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline)

The CAC Pipeline, similar to the Sonoma Pipeline, would not involve the transport, use, or disposal of hazardous materials. Construction of the pipeline would not involve any notable use of hazardous materials; however, if hazardous materials were encountered during construction, removal and transport could occur. Overall, the development of the CAC pipeline would not create a hazard through the routine transport, use, or disposal of hazardous materials. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction plans have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that potential impacts related to creating a hazard through routine transport, use, and disposal of hazardous materials impacts would be comparable to those described above for the currently proposed pipelines. The potential for encountering contamination during construction activities may be slightly greater for the potential future pipelines than for the currently proposed pipelines because of the comparatively more urban setting of the future pipelines; however, the extent and frequency of such excavation, transport, and disposal are not expected to be substantial. Moreover, any such activity would be subject to federal, state, and local safety requirements. As such, no significant impacts associated with implementation of the potential future pipelines are expected to occur. This impact is considered less than significant. No mitigation is required.

9.2.7.2 Impact Haz-8: Hazard Created through Reasonably Foreseeable Upset and Accident Conditions Involving Release of Hazardous Materials

Water Delivery Project Component (Sonoma Pipeline)

There is a low potential for construction of the Sonoma Pipeline to encounter subsurface contamination. None of the records from the databases searched (VISTA Information Solutions 2002) suggest that reasonably foreseeable upset and accident conditions exist along the pipeline corridors that could create a notable hazard involving the release of hazardous materials. Once operational, if the pipeline were to leak or break, recycled water could be released to nearby and underlying areas. Even in the unlikely event that a substantial leak or break in the pipeline occurred, recycled water is not a hazardous material. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

Segment 1 of the Napa Pipeline has been evaluated previously for hazards caused by accident conditions involving the release of hazardous materials. Segment 2 is included within the 1-mile radius of the database search for the Sonoma Pipeline. As described above under the Sonoma Pipeline, there is a low potential for construction of the pipeline to encounter subsurface contamination. Once operational, if the pipeline were to leak or break, recycled water could be released to nearby and underlying areas. However, as stated above, recycled water is not a hazardous material. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline)

In comparison to the Sonoma Pipeline, there is a slightly greater chance that construction of the CAC Pipeline would encounter subsurface contamination, based on the comparatively greater number of hazardous materials sites found in the database search. None of the records found, however, suggests that reasonably foreseeable upset and accident conditions exist along the pipeline corridors that could create a notable hazard involving the release of hazardous materials. This impact is considered less than significant. No mitigation is required.

Should it become necessary to temporarily store contaminated material during construction, a contingency plan would be developed that would include provisions to prevent contaminated runoff. This impact is considered less than significant. No further mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is possible that construction activities associated with pipeline construction could encounter subsurface contamination. There is not, however, information at this time suggesting that construction and operation of the potential future pipelines would create a significant hazard through reasonably foreseeable upset and accident conditions involving release of hazardous materials. Should contamination be encountered, it would be addressed in accordance with federal, state, and local hazardous waste safety requirements. This impact is considered less than significant. No mitigation is required.

9.2.7.3 Impact Haz-9: Exposures Resulting from Exceeding Human Health Criteria

Water Delivery Project Component

An impact on human health from the operation of the Sonoma Pipeline, CAC Pipeline or the Napa Pipeline is not anticipated, as the quality of the water from the WWTPs is strictly enforced through federal, state, and local laws and regulations.

It is possible that pipeline construction activities could encounter subsurface contamination, posing the potential for workers and the nearby public to be exposed to a health hazard. Based on the results of the database records search and the relative setting for the Sonoma Pipeline and Napa Pipeline, there is no evidence of major contamination or other notable exposure hazards being present along the pipeline route. However, past use of the adjacent railroad line poses the potential for contamination. Additionally, there is the possibility of contamination being encountered during subsurface excavation.

Construction activities, including subsurface excavation, are subject to Cal/OSHA safety requirements that serve to avoid worker exposure to hazards in excess of specified human health criteria and that also provide for the protection of the nearby public. Construction projects typically include the preparation and implementation of a construction safety plan to address the possibility of encountering contamination or other hazards. Construction safety plans typically include details regarding how construction will be performed so as not to expose workers or the public to contamination levels in excess of appropriate permissible exposure levels. Such plans typically identify contingency approaches and construction procedures should contaminated concentrations in excess of permissible exposure levels or an explosion hazard exist in the work area. Compliance with safety plan requirements provides a means to minimize the risk of exposure exceeding human health criteria during construction activities.

Potential impacts of construction of the CAC Pipeline are considered slightly greater than those mentioned above for the Sonoma and Napa Pipelines. The Sonoma and Napa Pipelines hazardous materials records search showed no notable sites along the alignment; however, results of the database search for the CAC Pipeline indicated 15 records (including two unmapped records) of hazardous material sites occurring within 0.125 mile of the CAC Pipeline alignment. Measures necessary to avoid exceeding human health criteria, including observing Cal/OSHA safety standards and preparing a construction safety plan, would be taken as outlined above.

This impact is considered significant. Implementation of Mitigation Measure Haz-5 would reduce this impact to a less-than-significant level.

Mitigation Measure Haz-5: Prepare and Implement a Safety Plan
Before beginning construction activity, each construction contractor will prepare and communicate to all workers who will be on-site a construction safety plan that addresses, among other things, measures to protect workers and the public from unacceptable exposure levels. The specifications of the safety plan will include, but not be limited to, the requirements of Cal/OSHA.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the potential Program Component of the Water Delivery Option. It is anticipated, however, that the potential for exposures exceeding human health criteria would be comparable to those described above for the Water Delivery Project Component. This impact is considered significant. Mitigation Measure Haz-5, "Prepare and Implement a Safety Plan," would reduce this impact to a less-than-significant level. This measure is described above.

9.2.7.4 Impact Haz-10: Safety Hazard Resulting from Proximity to an Airport

Water Delivery Project Component (Sonoma Pipeline)

There are no airports in close proximity to the construction area proposed for the Sonoma Pipeline. There would be no safety hazards as a result of construction for this pipeline alignment. Therefore, there would be no impact. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

The beginning of the proposed Napa Pipeline is located near the Napa County Airport. This segment has been evaluated in a previous CEQA document.

Because the airport is not heavily used, and given the distance of the pipeline construction area to the airport, the Napa Pipeline is not expected to create a hazard for airport operations. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline)

The proposed CAC Pipeline is located in proximity to the Napa County Airport. The subject airport is not a commercial facility; hence it is not heavily used. Construction of the closest portion of the pipeline to the airport would occur approximately 4,000 feet from the Napa County Airport. Given the nature and operational characteristics of the airport and the relative distance from the pipeline construction area, construction of the CAC Pipeline is not expected to create a hazard for airport operations. Because the pipeline would be underground, this impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. However, the Marin County Airport–Gnoss Field could be potentially in the vicinity of the proposed pipeline from the Novato SD's WWTP. Also, the Petaluma Municipal Airport could be in the vicinity of the proposed pipeline from the City of Petaluma WWTP. Neither of these airports is heavily used. If an alignment is proposed in the proximity of an airport, it is anticipated that the potential impact would be comparable to those described above for the Water Delivery Project Component. This impact is considered less than significant. No mitigation is required.

9.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts associated with the habitat restoration options are similar to those under the salinity reduction options, because the types of activities potentially involving hazardous materials/wastes are similar.

9.2.8.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Habitat Restoration Option 1 would include repairs to existing water conveyance structures, removal of existing water conveyance and control structures, repairs to existing levees, and

long-term maintenance of levees and water conveyance/control structures for the ponds that are retained as ponds. No new water control/conveyance structures are anticipated as part of the habitat restoration options (i.e., it is assumed that all necessary water control/conveyance structures would have been installed as part of the salinity reduction effort). Similarly, all levees would have been upgraded as necessary during the salinity reduction phase, so that only maintenance would be required for those levees that are required for the long term. Breaching of exterior levees with explosives (for those ponds opened to substantial tidal action) is discussed below.

Conventional construction activities would include transporting construction materials, such as fuels and oils, and the use of heavy machinery. Of particular concern are the construction activities required on the island ponds (Ponds 2, 3, 4/5, and 6/6A), because fuel and other hazardous materials associated with the operation of the machinery would have to be transported through the sloughs. Construction in these areas would be limited to the removal of existing water control structures (at Pond 6/6A only if that pond is eventually opened to tidal action). Thus, there could be accidental releases of these materials into the environment. Although any contractors working in the project area would be required to follow all applicable laws and regulations, this impact is considered significant because of the ecological sensitivity of the area. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.8.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

Levee breaches for habitat restoration would be more extensive than levee breaches required during desalination. Under Habitat Restoration Option 1, exterior levee breaches are required for Ponds 3 and 4/5, as well as the levee breaches potentially required for Pond 6/6A. Some of these levee breaches would be located along the Napa River, and others would be located in the less-accessible sloughs. Except where removal of existing water control structures results in a sufficiently large levee breach for habitat restoration purposes, levee breaches would be accomplished using explosives. Improper handling, placement, or detonation of these explosives could result in residual chemicals being released to the environment. In addition, excessive charge sizes could result in larger breaches than desired. This impact is considered significant. Implementation of Mitigation Measure Haz-2, "Employ Explosives Experts when Breaching Levees," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 (Impacts Haz-2 and Haz-4) are slightly different from those under Habitat Restoration Option 1. These impacts are described below.

9.2.9.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Habitat Restoration Option 2 are more extensive initially and would occur in more areas than under Habitat Restoration Option 1. Long-term construction activities would be somewhat less extensive, as more ponds would be opened up to substantial tidal action and would not require any long-term maintenance. Conventional construction activities would include creation of a north-south levee across the narrow center portion of Pond 2, in addition to the other activities described for Habitat Restoration Option 1. Thus, this impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.9.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

Levee breaches for habitat restoration would be more extensive under Habitat Restoration Option 2 than under Habitat Restoration Option 1. Exterior levee breaches would be required for Ponds 2 (eastern half), 3, 4/5, and 6/6A. Thus, this impact is considered significant. Implementation of Mitigation Measure Haz-2, "Employ Explosives Experts when Breaching Levees," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts Haz-2 and Haz-4) are slightly different from those under Habitat Restoration Option 1. These impacts are described below.

9.2.10.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Habitat Restoration Option 3 are less extensive initially and would occur in fewer areas than under Habitat Restoration Options 1 and 2. Long-term construction activities would be more extensive, because more ponds would be retained as ponds and would require long-term maintenance. Thus, this impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.10.2 Impact Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees

Levee breaches for habitat restoration would be less extensive under Habitat Restoration Option 3 than under Habitat Restoration Option 1. Exterior levee breaches would be required only for Ponds 3 and 4. Nonetheless, this impact is considered significant. Implementation of Mitigation Measure Haz-2, "Employ Explosives Experts when Breaching Levees," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

9.2.11 Habitat Restoration Option 4: Accelerated Restoration

The impact under Habitat Restoration Option 4 is nearly the same as that under Habitat Restoration Option 1 for Impact Haz-4; Impact Haz-2 is slightly different and is described below.

9.2.11.1 Impact Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities

Conventional construction activities associated with Habitat Restoration Option 4 are considerably more extensive initially and would occur in many more areas than under Habitat Restoration Option 1. The added design features associated with Habitat Restoration Option 4 include filling up to 100 acres of pond area to an elevation near MHHW and significantly increasing the length of starter

channels with berms. This increase in construction effort and duration increases the potential for accidental hazardous materials/wastes exposures and releases. Construction activities would be more intensive than those under Habitat Restoration Option 1. This impact is considered significant. Implementation of Mitigation Measure Haz-1, "Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

Chapter 10

Transportation and Circulation

10.1 Environmental Setting

10.1.1 Introduction and Sources of Information

This chapter describes the transportation and circulation setting in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project.

Information about the local roadway network is based on information from California State Automobile Association and USGS topographical maps. Existing highway conditions were obtained from Caltrans traffic data. Napa River conditions were compiled using data from the Corps' Napa River Maintenance Dredging Project. Information regarding the Napa County Airport and its operations was obtained from the Napa County Airport website (http://www.co.napa.ca.us/internet/content/departments/airport/). Also used for reference were *Stanly Ranch Specific Plan Draft EIR* (Brady/LSA, August 1998) and *Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration* (Napa Sanitation District, January 11, 1995).

10.1.2 Regulatory Setting

10.1.2.1 California Department of Transportation Encroachment Permit

Caltrans is responsible for planning, designing, constructing, operating, and maintaining state-owned roadways. Caltrans issues permits for projects affecting the ROWs of state-owned roadways and for encroachment on land within its jurisdiction to

- ensure that the proposed encroachment is compatible with the primary uses of the state highway system,
- ensure the safety of both the permittee and the highway user, and
- protect the state's investment in the highway facility.

Actions proposed within, under, or over a state highway ROW—such as rerouting and protecting infrastructure; opening or excavating a state highway for any purpose; constructing and maintaining road approaches or connections to an ROW; grading within the ROW on any state highway; or placing, changing, or renewing an encroachment—require an encroachment permit. An encroachment requiring permanent access or maintenance within a freeway or expressway ROW can be considered for a permit only if the following restrictions are met.

- The encroachment is related to a public facility or to a utility dedicated to public use.
- Alternative locations for the encroachment are inordinately difficult or unreasonably costly.
- The encroachment is as near as possible to the outer boundary of the ROW.
- The encroachment is approved by the Chief of the Caltrans Office of Project Planning and Design and possibly also by the Federal Highway Administration when federal facilities or funds are affected.

10.1.2.2 Level of Service Ratings

Caltrans has developed a level of service (LOS) grading system that compares the capacity of a roadway section to the traffic volumes that use that section. There are six LOS grades, A–F, which indicate traffic efficiency at peak-hour traffic periods. For example, a "B" rating would indicate that the roadway supports stable flow conditions and that driving speeds may be slightly restricted during peak traffic. A "D" rating indicates low speeds, forced flow conditions, and major delays at signals (Table 10-1).

~~The Napa County General Plan encourages the use of the Napa River and its tributaries for industry and recreation.~~

Table 10-1. Level of Service Definitions

Level of Service Rating	Definition
A	Free flow; insignificant delays.
B	Stable operations; minimal delays.
C	Stable operations; acceptable delays.
D	Approaching unstable; queues develop rapidly but no excessive delays.
E	Unstable flow; significant delays.
F	Forced flow; low operating speeds.

10.1.3 Regional Setting

The Napa River Unit is located at the north end of San Pablo Bay, which is part of the Bay-Delta estuary. Interstate 80 (I-80) and SRs 37, 29, 12, and 121

provide regional access to the north bay region. I-80 is a principal southwest-northeast freeway that connects SR 37 to the Bay Area in the southwest and to Fairfield in the northeast. SR 37 parallels the site and runs from east to west, connecting I-80, U.S. 101, SR 29, and SR 121 to the project site. SR 37 provides access to the project site. SR 29 in Vallejo extends north into Napa County from I-80. SR 12 parallels the project site to the north and extends to the west from SR 29, and provides access to the project site from the north.

Several railroad lines are located in the north bay region, including lines that generally parallel portions of U.S. 101, SR 37, and SR 121. See Figure 10-1 for general locations and alignments of the subject roadways and railroad lines.

10.1.4 Project Setting

The project-area transportation network consists of SR 37, four light-duty access roads, two perimeter dirt roads, and the Napa River.

10.1.4.1 Existing Roadway Network

SR 37 provides the primary access to the levee bordering Ponds 1 and 1A ~~near Pond 2~~ in the south. Duhig Road connects the project site to SR 12/121 to the north. Milton and Buchli Station Roads also provide access to Ponds 7, 7A, and 8 at the north edge of the project site. These two roads are lightly traveled and are used primarily by agricultural vehicles and local residents. There are no public roads within the project site except Milton Road, which extends down Edgerley Island adjacent to Pond 8 and at the north end of the project area.

Caltrans's Office of Traffic Data maintains records of the annual average daily traffic level for SR 37 and SR 12/121. Peak-hour traffic is one criterion that determines the LOS. The peak-hour traffic flow for the section immediately adjacent to the project site along SR 37 is 2,816 vehicles, and along SR 12/121 at Duhig Road, 2,750.

Based on current service conditions, Caltrans has assigned an LOS grade of B to the section of SR 37 immediately adjacent to the project area. Traffic volumes increase as the highway continues east into Vallejo; the LOS is D for various sections of the highway there. There are no LOS grades for surface roads.

For the Water Delivery Option, the project area encompasses Green Island Road, which provides access to the former salt evaporator area from the adjacent UPRR line (to the northeast). This road currently experiences very little traffic, as it is not a through street and terminates at the former Cargill Salt facility adjacent to, and east of, the Napa River. Stanly Lane is also not a through street and is lightly traveled by local residents. Additionally, the project area includes Buchli Station Road, described above.

10.1.4.2 Navigation (Recreation and Industrial)

The Napa River provides water access to the project area, connecting the project site to San Pablo Bay in the south and Napa in the north. The Napa River navigation channel is approximately 1,000 feet wide and 15 feet deep. Several sloughs extend from the Napa River to the west. From south to north, the sloughs are Dutchman Slough, South Slough, China Slough, and Napa Slough. Depending on the tides, each of these sloughs can provide access to various locations in the project site. The Napa River supports navigation of pleasure craft, tugboats, and barges. The Napa County General Plan encourages the use of the Napa River and its tributaries for industry and recreation.

The Petaluma River, which extends from the north side of the city of Petaluma to San Pablo Bay within the project area, is used for recreational and industrial navigational purposes similar to those for the Napa River system.

10.1.4.3 Railroad

Two railroad lines are located within the study area of the pipelines currently proposed for the Water Delivery Option.

- One railroad line, owned by NWPRA, traverses the Sonoma Pipeline study area and generally extends in an east-west direction from SR 12/121 to, and past, the Napa River. This segment of railroad line has not been used for several years because the previous freight operator went out of business; however, NWPRA expects that a new freight operator will take over operation of the subject line.
- The other railroad line, owned and operated by California Northern Railroad and currently in service, extends in a northwest-southeast direction east of the Napa and CAC Pipeline study areas. This line is part of a major north-south rail transportation system.

Figure 10-1 shows the locations of the two railroad lines that extend through the local study area for the Water Delivery Option.

10.2 Environmental Impacts and Mitigation Measures

10.2.1 Methodology and Significance Criteria

Impacts on traffic were analyzed quantitatively by

- comparing existing LOS data with potential traffic increases resulting from the proposed project,

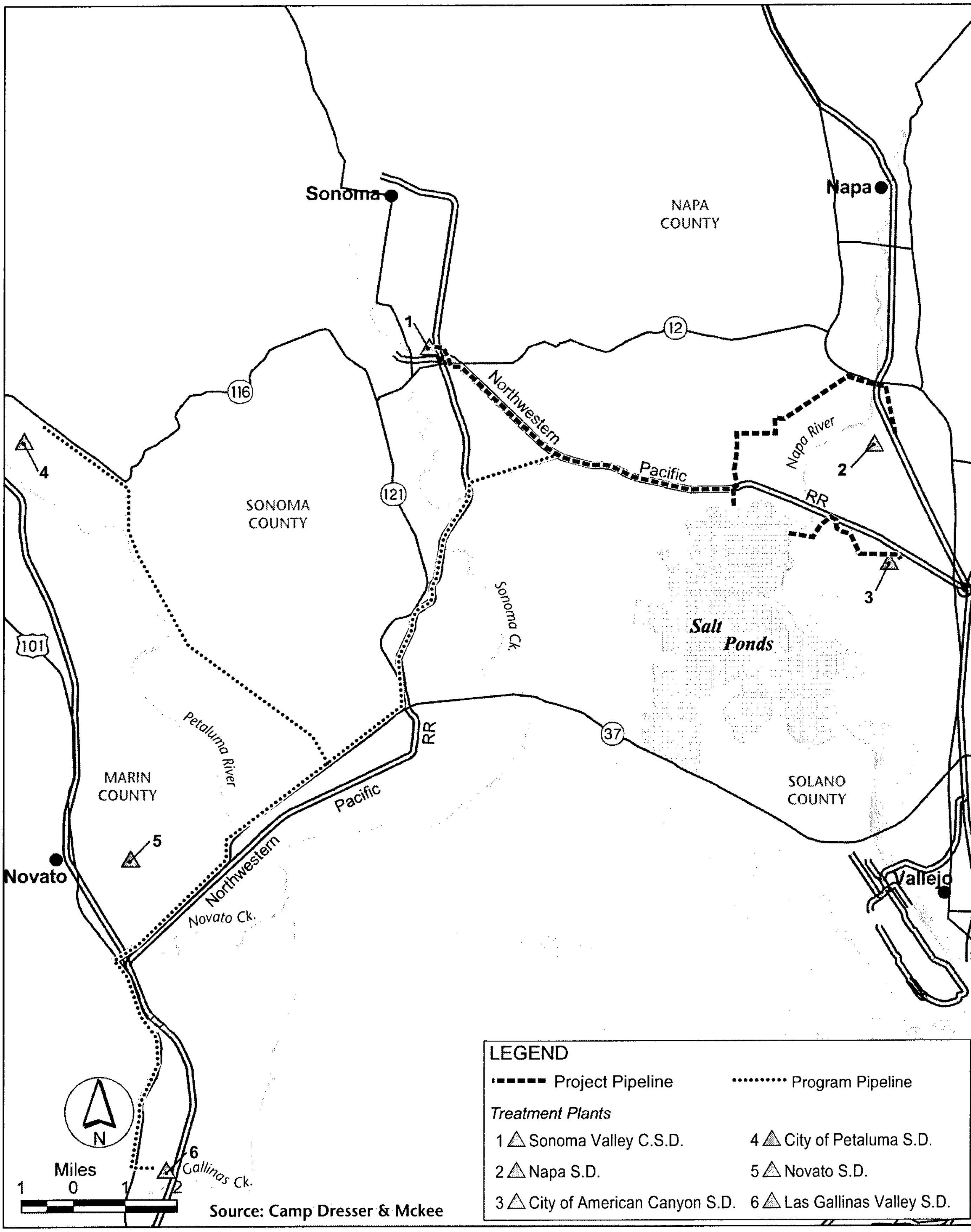

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Figure 10-1
Highway and Railroad Lines Near the Project and Program Pipeline Alignments

- calculating the total number of daily trips generated during the construction phase, and
- estimating equipment needed during project construction.

Criteria based on the State CEQA Guidelines were used to determine the significance of transportation and traffic-related impacts. The project would have a significant impact on transportation and traffic if it would

- cause an increase in traffic that is substantial in relation to existing traffic load and capacity of the street system;
- cause, either individually or cumulatively, exceedance of an LOS standard established by the state congestion management agency; or
- substantially increase traffic or navigation hazards because of a design feature.

10.2.2 No-Project Alternative

10.2.2.1 Impact T-1: Temporary Increase in Traffic Volumes as a Result of Emergency Repairs

Limited levee reconstruction would occur in the event of a failure or catastrophic breach of the levees. The timing and duration of these reconstruction activities are unknown because they would depend on the extent of levee damage and the need for emergency repairs. However, emergency levee repairs could be expected to generate a temporary increase in traffic because of the vehicles and equipment needed for such repairs. Traffic volumes on the primary routes to the site are already high; these temporary increases would not substantially increase the traffic load on either SR 37 or SR 12/121. Therefore, this impact is considered less than significant. Because this alternative would result in no project being implemented, and because this impact is less than significant, ~~N~~no mitigation is required.

10.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

10.2.3.1 Impact T-2: Temporary Increase in Traffic Volumes as a Result of Project Construction

The ~~terrestrially~~ land-accessible ponds requiring maintenance are Ponds 1A, 7, 7A, and 8. Levee and other~~canal~~ reconstruction activities at Pond 1A would require approximately 5 daily truckloads, and Ponds 7 and 7A would require multiple (approximately 20) daily truckloads during the related construction period. Pond 8 would require minor repair or replacement of water control

structures. SR 37 provides access to Pond 1A. Milton Road is a surface road at the north end of the project that would provide immediate project-site access to Ponds 7, 7A, and 8. Most other construction areas would be accessed via the Napa River and the network of sloughs throughout the project area. Pond 1A repairs would likely be accomplished by transporting materials overland then by barge to the work area. Table 10-2 lists the vehicles needed for construction and the purposes of these vehicles.

Project construction is not expected to substantially increase the existing traffic level on SR 37 or SR 12/121. Construction activities at Pond 1A are expected to result in approximately 5 daily loads of traffic on SR 37. Construction activities at Ponds 7, 7A, and 8 are expected to result in an addition of approximately 20 daily loads of traffic at the intersection of Milton Road and SR 12/121. These numbers are not considered large enough to increase volume and decrease level of service. Traffic levels on these roads have sufficient capacity to handle this small increase. In addition, construction-related impacts would be temporary and limited to delivery of materials for levee repair and/or canal maintenance. Therefore, this impact is considered less than significant. No mitigation is required.

10.2.3.2 Impact T-3: Increase in Construction-Related Traffic Hazards

Construction-related activities would not substantially increase traffic hazards on local or regional roadways. Construction activities would be removed from traffic flow, would not require alteration to fit current traffic patterns, and would require limited off-site transport of materials; therefore, no increase in construction-related traffic hazards is anticipated. This impact is considered less than significant. No mitigation is required. If necessary, proper safety signage would be used to warn motorists of potential hazards.

10.2.3.3 Impact T-4: Increase in Watercraft Traffic in the Napa River

Diesel-powered barges and small boats would be used to access construction areas within the project site that are not terrestrially accessible. The Napa River would provide a navigation route for barges and small boats that would transport construction equipment and construction workers from an off-site staging area to the construction sites in the project area. Barges would make several daily trips transporting construction equipment between the staging area and internal construction sites. Small boats would be used as needed by construction crew traveling between staging areas and construction sites that are not accessible terrestrially. With the possible exceptions of Ponds 1, 1A, 7, 7A, and 8, all levee reconstruction material would be dredged from the pond and placed on the existing levee. It would also be necessary to transport equipment to levee breach locations on a barge. Barges with shallow drafts would be needed because of the

shallow depth of the Napa River adjacent to the levees; many deliveries would occur during high tide to minimize the possibility of the barge becoming trapped in the mud. Table 10-2 describes the type and number of each piece of equipment associated with levee repair and breaching. Construction equipment would operate from atop the levees to repair and breach in locations identified on the project map (Figure 10-1) and would use existing borrow ditch material. Daily watercraft trip levels in the Napa River are not monitored by a government agency; watercraft use associated with this option probably would not greatly affect the number of watercraft using the river. Therefore, this impact is considered less than significant. No mitigation is required.

Table 10-2. Projected Construction Vehicles and Other Resources Necessary for Levee Improvements

Vehicle or Resource (number projected)	Purpose	Comments
Long-reach excavator (1–2)	Move dredged materials within the project site	Excavator(s) would remain at the project site until construction phase is complete
Diesel-powered barges (2–3)	Transport construction equipment from an off-site staging area to the construction sites within the project area	The number of daily trips is approximately 2
Small to medium bulldozers (1–2)	Repair and construct levees	Bulldozers would remain at the project site until construction phase is complete
Land-based dump trucks (5–6)	Transport levee material to/from terrestrially accessible levees	The number of daily trips is approximately 2
Small clamshell dredge (1)	Collect dredge material to reinforce existing levees	Dredge would remain at project site until construction phase is complete
Sheetpile driver (1)	Drive sheetpiles into Bay Mud during construction dewatering	Sheetpile driver would remain at the project site until construction phase is complete
Small boats (1–2)	Transport construction workers from an off-site staging area to the construction sites within the project area	The number of daily trips is approximately 8

10.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts T-2, T-3, and T-4) are nearly the same as those under Salinity Reduction Option 1A except that fewer trips would be required because less construction would occur on Pond 3.

10.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts T-2, T-3, and T-4) are nearly the same as those under Salinity Reduction Option 1A except that fewer trips would be required because less construction would occur on Ponds 3, 4, and 5.

10.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Impacts T-2, T-3, and T-4) are nearly the same as those under Salinity Reduction Option 1A.

10.2.7 Water Delivery Option

10.2.7.1 Impact T-2: Temporary Increase in Traffic Volumes as a Result of Project Construction

Water Delivery Project Component

Construction of the Sonoma, CAC, and Napa Pipelines could temporarily increase the traffic along local roadways. Roads near the Sonoma Pipeline that may be used for construction-related travel include Ramal, Duhig, Las Amigas, and Buchli Station Roads, all of which are rural roads with relatively light traffic during weekday hours, and SR 12/121 and SR 37, which provide areawide access to regional highways such as I-80 and U.S. 101. Roads near the Napa Pipeline also include Las Amigas and Buchli Station Roads as well as Stanly Lane, Cuttings Wharf Road, and Milton Road.

In July 1999, Napa County performed traffic counts on Las Amigas Road and Duhig Road. On Las Amigas Road, county personnel found 318 vehicles 60 yards east of Duhig Road; 1,501 vehicles 30 yards north of the Milton intersection; and 590 vehicles 30 yards east of Buchli Station Road. On Duhig Road, they found 675 vehicles 30 yards south of Las Amigas Road and 902 vehicles 30 yards north of Las Amigas Road. Caltrans has monitored SR 121 and found an average of 30,500–33,500 trips per day at Duhig Road and an average of 18,600–19,000 trips per day at 8th Street (California Department of Transportation 2002).

Roads near the CAC Pipeline that may be used for construction travel include Green Island Road, SR 29/12, and I-80. Caltrans found an average of 40,500 trips per day on SR 29 at Green Island Road (California Department of

Transportation 2002). The construction-related increase in traffic associated with either pipeline would be negligible, as described below.

Trips generated in conjunction with pipeline construction activity would typically include

- worker commutes that, assuming an average crew size of 10 and use of crew (pickup) trucks to transport the workers, would generate approximately four trips per day;
- equipment/supply deliveries at an average of one truck trip per day, which using a passenger car equivalent factor of 2.0 (i.e., the movement of one truck in traffic would have the same impact on traffic movements as two passenger vehicles), would generate two (passenger car equivalent) trips per day;
- export of earth from trenching operations at an average rate of six truck trips per day, which equals 12 passenger car equivalent trips; and
- miscellaneous trips of approximately four per day.

As such, the total daily trip generation associated with construction activities would be approximately 22. Most of these trips would occur during nonpeak travel hours. Although there would be additional trips associated with individual workers traveling to and from the crew assembly–pickup/dropoff area, these trips, which would total 20 per day at most, are also considered to be negligible and most, if not all, would occur during nonpeak travel hours. Such capacity impacts would be temporary (a total of 1 year) and transitory in nature (i.e., construction-related trips would occur in different areas and possibly on different streets, depending on the active segment of construction along the pipeline route). Even if dual (or triple for the Sonoma alignment) crew teams are applied for multiple work sites on alignment of each pipeline, the increased trip generation (i.e., approximately 44–66 trips per day per pipeline) occurring primarily during nonpeak travel hours would not represent a substantial increase in traffic on the local street system.

In summary, implementation of the proposed Project Component of the Water Delivery Option would not result in a substantial increase in existing traffic volumes. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option (i.e., pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs). It is anticipated, however, that the general nature of construction activity and associated trip generation for those pipelines would be comparable to that described above for the Sonoma, CAC, and Napa Pipelines. Given the relatively low volume of construction trips and the fact that most trips would occur during

nonpeak travel hours, implementation of any of the potential future pipelines is not expected to cause an increase in traffic that is substantial to the existing traffic load and capacity of the local street system. This impact is considered less than significant. No mitigation is required.

10.2.7.2 Impact T-3: Increase in Construction-Related Traffic Hazards

Water Delivery Project Component (Overview)

As subsurface facilities, neither of the currently proposed pipelines would increase traffic hazards because of a design feature. Construction of the pipelines could, however, introduce temporary hazards. Such hazards could affect

- rail traffic for the portion of the Sonoma Pipeline proposed to be constructed within a railroad ROW,
- roadway traffic for the portion of the Sonoma Pipeline proposed to be constructed along the access road to the Napa River Unit,
- roadway traffic for the portion of the CAC Pipeline proposed to be constructed along Green Island Road, and
- roadway traffic for the portion of the Napa Pipeline proposed to be constructed along Buchli Station Road.

Potential impacts specific to each segment are described below.

Water Delivery Project Component (Sonoma Pipeline and Railroad Right-of-Way)

The proposed Sonoma Pipeline includes a 5,100-foot segment along the south side of the existing railroad tracks and a 12,000-foot segment along the north side of the railroad tracks. Currently, there are no railroad operations on this particular length of track. Should operation of this railroad line resume before or during development of the Sonoma Pipeline, there would be the potential for construction-related hazards to, or from, railroad traffic. This impact is considered significant. Implementation of Mitigation Measure T-1 would reduce this impact to a less-than-significant level.

Mitigation Measure T-1: Implement Safety Plan for Pipeline Construction along Rail Line

Before beginning pipeline construction, the general contractor will coordinate with appropriate rail line officials to (1) assess the likelihood and timing, if any, of resuming operation of the subject line; and (2) prepare and implement, as appropriate, a safety plan specifically addressing potential hazards associated with rail operations occurring during the construction program. The plan will

address, among other things, appropriate safety setback requirements for equipment and construction personnel relative to the track location, procedures to be followed when a train approaches and passes by the construction site, communication protocols, and specifications for how the construction site is to be secured during nonworking hours/days. The general contractor will ensure that the safety plan is provided and properly communicated to all subcontractors and field personnel, as appropriate.

Water Delivery Project Component (Sonoma Pipeline and Napa River Unit Access Road)

The Sonoma Pipeline includes a segment of approximately 4,200 feet that would be constructed along the access road to the Napa River Unit. The majority of this road is a service road accessible only to, or through, DFG personnel and is not available to the general public. Given the very low volume of traffic and slow travel speeds on this road, especially during weekdays when construction activity would be occurring, no notable traffic hazards are anticipated. DFG personnel would need access to the marsh area at all times for routine monitoring and maintenance, and all construction activities would be coordinated with their field staff. The construction activity area would be clearly delineated, would be readily visible to motorists, and would include a flagman if and as appropriate. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (CAC Pipeline and Green Island Road)

Development of the CAC Pipeline would include construction activity along Green Island Road that could extend into travel lanes. This impact is considered significant. Implementation of Mitigation Measure T-2 would reduce this impact to a less-than-significant level.

Mitigation Measure T-2: Implement Safety Plan for Construction along Public Roads

For each pipeline project, the construction contractor will prepare and implement a traffic safety plan for construction activities along a public road. The~~is~~ requirement for this plan will be included in the construction plan specifications for the project. Specifications will include the requirement for each plan to be submitted for review and approval by the traffic engineering department(s) with jurisdiction over the potentially affected roadways, including Caltrans for activities proposed on any state highway. The plan will require the construction contractor to provide and maintain typical measures such as placement of signage, high-visibility traffic cones, nighttime lights/reflectors, and/or other such safety markers around the activity area, extended a sufficient distance to allow motorists to safely maneuver around the area in advance. If and as appropriate, traffic control personnel/flagmen will be used.

Water Delivery Project Component (Napa Pipeline and Buchli Station Road)

Transportation effects for the roadways in Segment 1 have been evaluated previously and found to be less than significant. Development of Segment 2 of the Napa Pipeline would include construction activity along Buchli Station Road that would extend into the travel lanes. This impact is considered significant. Implementation of Mitigation Measure T-2, described above, would reduce this impact to a less-than-significant level.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component. It is anticipated, however, that construction of the potential future pipelines would include activities along portions of several major roadways including U.S. 101 and SR 37, SR 116, and SR 121. Such activity poses the potential for significant traffic hazard impacts, especially given the high traffic volumes and travel speeds along some segments.

In addition to construction along major roadways, the Program Component includes pipeline segments that would likely occur along railroad ROWs. These impacts are considered significant. Implementation of Mitigation Measures T-1, "Implement Safety Plan for Pipeline Construction along Rail Line," and T-2, "Implement Safety Plan for Construction along Public Roads," would reduce these impacts to a less-than-significant level. These measures are described above.

10.2.7.3 Impact T-5: Individual or Cumulative Exceedance of an Established Level-of-Service Standard

Water Delivery Project Component

Construction of the Napa, CAC, and Sonoma Pipelines, as described above, would not result in a significant increase in traffic. The construction-related traffic generation would be low in volume and temporary (a total of 1 year) and transitory in nature, and would occur primarily during nonpeak travel hours. As such, it is unlikely that the construction traffic would cause an exceedance of an LOS standard, be it a congestion management plan standard or a local standard. This conclusion applies to both the Sonoma Pipeline, CAC Pipeline, and the Napa Pipeline, individually and in combination.

If the three projects were to be constructed simultaneously, the total traffic generation at the construction site would only be approximately 66 trips per day, or 120–125 trips per day if dual (or triple for the Sonoma Pipeline) work crews were used on each pipeline. The vast majority of these trips would occur during

nonpeak travel hours on rural roadways that have relatively light traffic during weekday hours. The exception would be SR 121, used for construction crew access for a segment of the Sonoma alignment; this highway is more frequently traveled than the rural roadways along the majority of the Sonoma, CAC, and Napa alignment. However, there would be only one crew using this access point, for approximately 20 trips per day. This additional traffic volume would not substantially increase the existing LOS. Additionally, given the relative locations of the three projects, there would be few, if any, roads that would be adversely affected by traffic from the projects. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that construction-related impacts of the potential future pipelines would be comparable to those described above for the Project Component. Implementation of each pipeline comprising the Program Component is not expected to cause an exceedance of an LOS standard. In the event that construction of the City of Petaluma, Novato SD, and LGVSD pipelines were to occur simultaneously, portions of SR 37 and SR 121 and possibly U.S. 101 would be affected by the combined total traffic of the three projects. That total, however, would be only about 66 trips per day, would be temporary and transitory in nature, and be distributed primarily during nonpeak travel hours. As such, it is unlikely that the combined construction traffic would cause an exceedance of an LOS standard. This impact is considered less than significant. No mitigation is required.

10.2.8 Habitat Restoration Option 1: Mix of Ponds and Tidal Marsh

Impacts under Habitat Restoration Option 1 are nearly the same as those under Salinity Reduction Option 1A for Impacts T-3 and T-4. Impact T-2 is slightly different and is described below.

10.2.8.1 Impact T-2: Temporary Increase in Traffic Volumes as a Result of Project Construction

Transportation impacts are expected to be limited to those from construction equipment necessary for levee repair and water control structure maintenance at Ponds 1, 1A, 2, 6/6A, 7, 7A, and 8. Construction activities would be less intensive than under the salinity reduction options. Therefore, this impact is considered less than significant. No mitigation is required.

10.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 (Impacts T-2, T-3, and T-4) are nearly the same as those under Salinity Reduction Option 1A. Slightly more watercraft traffic may be generated as a result of more initial construction for habitat restoration.

10.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts T-2, T-3, and T-4) are nearly the same as those under Salinity Reduction Option 1A. Slightly more watercraft traffic may be generated as a result of increased maintenance and repair of the Pond 4/5 levees.

10.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 are nearly the same as those under Salinity Reduction Option 1A for Impacts T-2 and T-3. Impact T-4 is slightly different and is described below.

10.2.11.1 Impact T-4: Increase in Watercraft Traffic in the Napa River

This option calls for proportionately more watercraft traffic than do the other options. This option would require delivery of dredged sediment from nearby areas and an increase in the number and length of starter channels and berms constructed in the ponds. A low-profile hopper dredge would be used to suction sediment from the designated sediment source, and would pump the sediment into the project area. The actual dredging would most likely occur as part of another project (i.e., the Napa River Federal Channel maintenance dredging), and impacts related to dredging are not addressed in the document. Only a slight increase in watercraft traffic would occur under this option, and this increase is not expected to adversely affect other watercraft traffic. Therefore, this impact is considered less than significant. No mitigation is required.

Chapter 11
Air Quality

11.1 Environmental Setting

11.1.1 Introduction and Sources of Information

This chapter describes air quality in the San Francisco Bay area in general and in the project area specifically. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project.

Air quality in the immediate project area and surrounding regional environment of the San Francisco Bay Area Air Basin (SFBAAB) would be affected by emissions from sources associated with the proposed construction activities and long-term operating activities in the project area.

The regulatory information described below focuses on regulations pertaining to mobile sources. Mobile sources are divided into four general categories:

- light duty on-road sources (passenger vehicles including cars and pickup trucks),
- heavy-duty on-road vehicles (trucks and buses),
- off-road vehicles (construction equipment), and
- marine vessels (all sizes).

The information presented in this section was compiled largely from information provided by the BAAQMD. References to other documents are provided as appropriate.

11.1.2 Regulatory Setting

The project area is subject to major air quality planning programs required by both the federal Clean Air Act (CAA), which was last amended in 1990, and the California Clean Air Act of 1988. Both the federal and state statutes provide for ambient air quality standards to protect public health, timetables for progressing toward achieving and maintaining ambient standards, and the development of

plans to guide the air quality improvement efforts of state and local agencies. The CAA requires states to submit a State Implementation Plan (SIP) for review and approval by EPA. The SIP must contain control strategies that demonstrate attainment with national ambient air quality standards (NAAQS) by deadlines established in the CAA. States that fail to submit a plan or to secure approval may be denied federal funding and/or be required to increase emission offsets for industrial expansion.

The state plan is called the Clean Air Plan (CAP) (BAAQMD 1997a). The CAP must show satisfactory progress in attaining state ambient air quality standards.

Because of the inability of the SFBAAB to attain the national ozone (O_3) standard, BAAQMD, ABAG, and the Metropolitan Transportation Commission (MTC) have developed the *Revised San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard* (O_3 Attainment Plan) (BAAQMD, ABAG, and MTC 2001). This plan provides measures that will reduce O_3 precursor emissions and bring the region into attainment of the 1-hour national O_3 standard within the next few years. The O_3 Attainment Plan has been adopted by BAAQMD, ABAG, and MTC and is presently being reviewed by the California Air Resources Board (CARB) before submittal to EPA. Once approved by EPA, the O_3 Attainment Plan will become part of the SIP.

The SIP and CAP overlap and generally contain the same emissions control measures. While state law requires the planning processes to be coordinated to the extent possible, updates for the federal and state plans are out of phase. The SIP control strategy is updated periodically at the direction of EPA, while the CAP is updated every 3 years as mandated by state law. Both the SIP and the CAP rely on the combined emission control programs of EPA, CARB, and BAAQMD.

Much of the strategy for reducing air pollution from mobile sources involves reducing emissions at the source. The EPA- and California-promulgated rules that have been implemented over several decades have effectively reduced emissions from gasoline-powered automobiles. EPA has recently begun this approach for diesel engines. Regulations requiring cleaner diesel engines in trucks and other heavy-duty equipment went~~will go~~ into effect in late 2002. Regulation of marine engines has lagged; standards for several classes of marine engines will come into effect in 2007. The role of each agency in controlling emissions in the project area is described below.

11.1.2.1 Federal Requirements

EPA oversees state and local implementation of CAA requirements. It sets NAAQS for criteria air pollutants (NAAQS are discussed in more detail below). EPA also sets emission standards for mobile sources, which include on-road motor vehicles, off-road vehicles, and marine engines. Finally, EPA sets nationwide fuel standards.

The conformity provisions of the CAA are designed to ensure that federal agencies contribute to efforts to achieve the NAAQS. EPA has issued two regulations implementing these provisions. The general conformity regulation addresses actions of federal agencies other than the Federal Highway Administration and the Federal Transit Administration. General conformity applies to a wide range of actions or approvals by federal agencies. Projects are subject to general conformity if they exceed emissions thresholds set in the rule and are not specifically exempted by the regulation. Such projects are required to fully offset or mitigate the emissions caused by the activity, including both direct emissions and indirect emissions over which the federal agency has some control.

A conformity analysis may be required for the Napa River Salt Marsh Restoration Project if emissions of reactive organic gases (ROG) and oxides of nitrogen (NO_x) are above the conformity thresholds of 50 tons of ROG and 100 tons of NO_x per year.

The federal-control programs described above are directed primarily toward criteria pollutants. There are also programs in place to reduce public exposure to other pollutants, such as those that increase the public's risk of developing cancer. These pollutants are called *hazardous air pollutants* (HAPs) in federal law and *toxic air contaminants* (TACs) in California law.

In response to public health concerns, Congress instructed EPA in 1990 to address emissions of HAPs from motor vehicles and their fuels. These instructions, contained in Section 202(1) of the CAA, consisted of two parts. First, EPA was instructed to study the need for and feasibility of controlling emissions of toxic air pollutants associated with motor vehicles and their fuels. Second, EPA was instructed to set standards for HAPs from motor vehicles and their fuels, or both.

EPA identified 21 compounds that should be considered Mobile Source Air Toxics (MSATs). The effectiveness of current controls in reducing highway emissions of these MSATs was evaluated. The analysis showed that the programs already in place to reduce O_3 and particulate matter inventories (including reformulated gasoline, national low-emission-vehicle emission standards for passenger vehicles, gasoline sulfur control requirements [Tier 2], 2007 heavy-duty vehicle standards, and highway diesel fuel sulfur control requirements) would yield significant reductions of MSATs. EPA also evaluated whether there were any additional controls that could be put in place to reduce highway MSAT emissions even more.

With regard to fuel-based controls, new gasoline toxic emission performance standards were set to ensure that refiners maintain their average 1998–2000 gasoline toxic emission performance levels. With regard to vehicle-based controls, EPA concluded that the Tier 2 and 2007 heavy-duty standards are the most stringent controls feasible at this time to reduce MSATs from highway vehicles and engines.

11.1.2.2 State and Local Requirements

Under California law, the responsibility to carry out air pollution control programs is split between CARB, EPA, and BAAQMD.

- BAAQMD can require stationary sources to obtain permits, and can impose emission standards, set fuel or material specifications, and establish operational limits to reduce air emissions.
- CARB shares the regulation of mobile sources with EPA and sets the California Ambient Air Quality Standards (CAAQS) (see below). CARB has the authority to set emission standards for on-road motor vehicles and for some classes of off-road mobile sources that are sold in California. CARB also regulates vehicle fuels; it has set emission reduction performance requirements for gasoline (referred to as *California reformulated gasoline*) and has limited the sulfur and aromatic content of diesel fuel to make it burn cleaner (this is referred to as *California diesel* or *California red-dyed diesel*).

The emission standards with the largest effect on the Napa River Salt Marsh Restoration Project are those set for marine and excavating equipment. Existing air quality in the project area is most strongly affected by on-road vehicle regulations.

TACs are pollutants "...which may cause or contribute to an increase in mortality or serious illness, or which may pose a present or potential hazard to human health" (BAAQMD 1997b). The California program for TACs involves two phases:

- the *identification phase*, in which chemical substances are formally identified as TACs based on their potential to harm the public; and
- the *control phase*, in which TAC emissions are reduced from selected sources when they are shown to cause significant levels of public exposure.

More than 240 chemical substances have been identified as TACs, and the list is updated periodically as more information is gathered about airborne chemicals and their potential health effects. Unlike criteria pollutants, there are no ambient standards for TACs. ~~TACs are pollutants "...which may cause or contribute to an increase in mortality or serious illness, or which may pose a present or potential hazard to human health" (BAAQMD 1997b).~~

The state program collects data on TAC emissions and ambient levels. When data show that public exposure is significant, CARB develops air toxic control measures (ATCMs) to reduce public exposure. The ATCMs can apply to stationary or mobile sources. BAAQMD adopts and enforces ATCMs and also uses its air permit program to evaluate and control the risk posed by TACs. BAAQMD requires sources to reduce TAC emissions to eliminate "hot spots" of public exposure from existing sources and prevent increases in TAC exposure from new or expanding stationary sources.

11.1.2.3 National and State Ambient Air Quality Standards

NAAQS and CAAQS have been established for O_3, carbon monoxide (CO), NO_x, sulfur oxides (SO_x), and particulate matter less than 10 micrometers in diameter (PM10). There are also ambient standards for several other pollutants (e.g., lead), but they are not discussed in this document because emissions of these pollutants from the project would be minimal. Ambient standards specify the concentration of pollutants to which the public can be exposed without adverse health effects. Individuals vary widely in their sensitivity to air pollutants, so standards are set to protect more sensitive populations (e.g., children and the elderly). The NAAQS and CAAQS are reviewed and updated periodically based on new health studies. CAAQS tend to be at least as protective as NAAQS and are often more stringent. The NAAQS and CAAQS are listed in Table 11-1.

Table 11-1. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [a]	National Standards [b]	
			Primary [c]	Secondary [d]
Ozone (O_3)	1-Hour	0.09 ppm (180 μg/m^3)	0.12 ppm (235 μg/m^3)	Same as Primary Standard
Carbon Monoxide (CO)	8-Hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	—
	1-Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	—
Nitrogen Dioxide (NO_2)	Annual	—	0.053 ppm (100 μg/m^3)	Same as Primary Standard
	1-Hour	0.25 ppm (470 μg/m^3)	—	—
Sulfur Dioxide (SO_2)	Annual	—	0.03 ppm (80 μg/m^3)	—
	24-Hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	—
	3-Hour	—	—	0.5 ppm (1,300 μg/m^3)
	1-Hour	0.25 ppm (655 μg/m^3)	—	—
Suspended Particulate Matter (PM10)	Annual (geometric)	30 μg/m^3	—	—
	Annual (arithmetic)	—	50 μg/m^3	Same as Primary Standard
	24-Hour	50 μg/m^3	150 μg/m^3	Same as Primary Standard

Notes:
ppm = parts per million; μg/m^3 = micrograms per cubic meter; mg/ m^3 = milligrams per cubic meter

[a] California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM10, and visibility-reducing particles are not to be exceeded. ~~The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.~~

[b] National standards other than 1-hour O_3 and 24-hour PM10 and those based on annual averages are not to be exceeded more than once a year. The 1-hour O_3 standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one. The 24-hour PM10 standard is attained when the 3-year average of the 99th percentile 24-hour concentrations is below 150 μg/m^3.

[c] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[d] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects from a pollutant.

11.1.2.4 Toxic Air Contaminants

As noted above, there are no ambient air quality standards for TACs. When TACs are identified, health effects data are evaluated on a case-by-case basis.

For TACs that are known or suspected carcinogens, CARB has consistently found that there are no levels or thresholds below which exposure is risk free. *Cancer risk* is defined as the lifetime probability (chance) of developing cancer as a result of exposure to one or a combination of cancer-inducing factors, including exposure to cancer-causing substances in the environment. The risk to any exposed individual is typically expressed in terms of chances in a million of contracting cancer (e.g., 1×10^{-6}). Cancer risk is estimated using conservative assumptions to minimize the chance of underestimating actual risk.

Individual TACs vary greatly in the risk they present. At a given level of exposure, one TAC may pose a hazard that is many times greater than another. To account for this difference in potency, health data pertaining to each TAC are evaluated. Where data are sufficient to do so, a "unit risk factor" is developed for cancer risk. The unit risk factor is expressed as the estimated number of individuals in a million who may develop cancer as the result of lifetime exposure to 1 $\mu g/m^3$ of the TAC.

For noncancer health effects of TACs, such as neurological damage, a similar factor called a *hazard index* is developed. The hazard index is based on values of acceptable ambient concentration levels (AACLs) that are specific to individual TACs and exposure periods.

11.1.2.5 New Standards and Recent State Action on Diesel Particulate Matter

New Standards

In July 1997, EPA adopted a number of changes to the NAAQS for O_3 and particulate matter (U.S. Environmental Protection Agency 1997a, 1997b, 1997c). These new standards are discussed separately because, from a regulatory standpoint, they have a different status from previously adopted standards. None of the new standards is effective because a 1999 federal court ruling blocked implementation. EPA is appealing this decision.

For O_3, EPA adopted a new 8-hour standard that was intended to replace the existing 1-hour standard. For particulate matter less than 10 micrometers in diameter (PM10), EPA adopted a 24-hour standard and an annual average standard. EPA retained the existing PM10 standards, but slightly changed the form of the 24-hour standard (U.S. Environmental Protection Agency 1997a, 1997b, 1997c).

The new O_3 standard was adopted after EPA found that the previous national 1-hour standard of 0.12 ppm did not adequately protect the public from adverse health effects. Of particular concern is evidence that exposure to O_3 levels below 0.12 ppm is associated with increased hospital admissions for people with respiratory ailments, including asthma, and with reductions in lung function in children and adults who are active outdoors (U.S. Environmental Protection Agency 1997c). There also is evidence that long-term exposure can cause

repeated inflammation of the lung, impairment of lung defense mechanisms, and irreversible damage to lung structure, leading to premature aging of the lungs and chronic respiratory illnesses (U.S. Environmental Protection Agency 1997c).

EPA's review of its particulate standard showed "coarse" respirable particles (PM10~~2.5~~) can be inhaled and aggravate health problems such as asthma. Therefore, EPA chose to retain the federal ~~PM2.5~~ PM10 standards. EPA also reviewed studies providing epidemiological evidence that exposure to particulate matter at levels well below the existing PM10 standards was associated with increased hospital admissions and premature mortality (U.S. Environmental Protection Agency 1997d). EPA found that finer particles (less than 2.5 micrometers in diameter) can penetrate more deeply into lungs, and are more likely than coarser particles to contribute to severe health effects (U.S. Environmental Protection Agency 1997d). Therefore, EPA established new standards for PM2.5.

Recent State Action on Diesel Particulate Matter

On August 27, 1998, CARB formally identified particulate matter emitted by diesel-fueled engines as a TAC. Diesel engines emit TACs in both gaseous and particulate forms. The particles emitted by diesel engines are coated with chemicals, many of which have been identified by EPA as HAPs, and by CARB as TACs. Diesel engines emit particulate matter at a rate about 20 times greater than comparable gasoline engines. Because by weight the vast majority of diesel exhaust particles are very small (92%–94% of their combined mass consists of particles less than 2.5 micrometers in diameter), both the particles and their coating of TACs are inhaled into the lung. Like other particles of this size, a portion will eventually become trapped within the small airways and alveolar regions of the lung. While the gaseous portion of diesel exhaust also contains TACs, CARB's August 1998 action was specific to diesel particulate emissions that, according to supporting CARB studies, represent 50%–90% of the mutagenicity of diesel exhaust (California Air Resources Board 1998). *Mutagenicity* is the capacity to induce mutation of cells. Mutagenicity is one indication of the cancer-causing potential of a chemical.

The California State Scientific Review Panel has identified a unit risk factor of 300 excess cancer cases per million persons exposed to a diesel particulate matter concentration of 1 $\mu g/m^3$. EPA currently designates diesel exhaust as a likely human carcinogen, but has stopped short of establishing a unit risk factor. EPA's Clean Air Scientific Advisory Committee (CASAC) has suggested that an annual NAAQS for PM2.5 would be adequately protective for long-term exposure to ambient diesel particulate matter (CASAC 2000).

The CARB action was taken at the end of a lengthy process that considered dozens of health studies, extensive analysis of health effects and exposure data, and public input collected over the last 9 years. The International Agency for Research on Cancer (IARC) had previously concluded that diesel exhaust was a "probable" human carcinogen. Based on the IARC's action, California listed diesel exhaust in 1990 as a chemical "known to the State to cause cancer" under

its "Proposition 65" program. Proposition 65, the California Safe Drinking Water and Toxic Enforcement Act, was passed by the voters in 1986. The act is therefore commonly known as the *Proposition 65 program*. Finally, EPA's evaluation of diesel exhaust (approved by CASAC) indicates that diesel exhaust is "likely to be carcinogenic" (DieselNet 2000).

CARB is in the process of developing regulations governing additional PM emission reductions. The Diesel Risk Reduction Plan was adopted by CARB on September 28, 2000. The plan focuses on particulate matter reductions as a means of achieving reductions in diesel exhaust risk. The goal is to reduce diesel particulate matter emissions by about 90% overall from current levels, using retrofit technology and requiring new engines to meet very low (0.01 gram/brake horsepower–hour) emission standards for particulate matter. New regulations will be developed to achieve these emission reduction goals for particulate matter.

11.1.3 Regional Setting

All construction and operating areas associated with the project and options are located in the SFBAAB. The SFBAAB is composed of the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara, along with the southeast portion of Sonoma County and the southwest portion of Solano County. The SFBAAB covers an area of approximately 5,540 square miles.

All construction and operating areas associated with the project and options are located in the SFBAAB. Air quality in the immediate project area and surrounding regional environment of the SFBAAB would be affected by emissions from sources associated with the proposed construction activities required to restore the ponds, as well as any long-term maintenance and recreational use of the project area.

11.1.3.1 Federal Attainment Status

Regions like the San Francisco Bay Area are given an air quality status designation by the federal and state regulatory agencies. Areas with monitored pollutant concentrations that are lower than ambient air quality standards are designated as *attainment areas* on a pollutant-by-pollutant basis. When monitored concentrations exceed ambient standards, areas are designated as *nonattainment areas*. An area that recently exceeded ambient standards, but is now in attainment, is designated as a *maintenance area*. Areas are often designated as *unclassified* when data are insufficient to have a basis for determining the area's attainment status. Nonattainment areas are further classified based on the severity and persistence of the air quality problem as *moderate, serious*, or *severe*. Classifications determine the minimum pollution control requirements. In general, the more serious the air quality classification,

the more stringent the control requirements that must be contained in the regional air quality plans (see discussion above of the SIP and CAP).

The SFBAAB is currently in attainment of the federal standards for NO_x and SO_x, in nonattainment for O_3 and CO (urbanized areas only), and unclassified for PM10 (California Air Resources Board 2001a). The urbanized areas of the SFBAAB are moderate nonattainment areas for CO.

11.1.3.2 State Attainment Status

CARB designates areas of the state as either in attainment or in nonattainment of the CAAQS. An area is in nonattainment if the CAAQS have been exceeded more than once in 3 years. At the present time, the SFBAAB is in nonattainment of the CAAQS for O_3 and PM10 and in attainment of the CAAQS for CO, NO_2, and SO_2 (California Air Resources Board 2001a). The SFBAAB is designated as a serious nonattainment area for O_3.

11.1.3.3 San Francisco Bay Area Air Basin Emissions

Table 11-2 displays the estimated annual average air emissions for the SFBAAB in 2000 (California Air Resources Board 2001b). Mobile sources are one of the largest contributors to air pollutants in the SFBAAB. Mobile sources account for approximately 60% of the reactive organic gases (ROG), 93% of the CO, 81% of the NO_x, 39% of the SO_2, and 12% of the PM10 emitted in the SFBAAB.

Table 11-2. 2000 Estimated Annual Average Emissions for the San Francisco Bay Area Air Basin (tons/day)

Source Type/Category	ROG	CO	NO_x	SO_2	PM10
Stationary Sources					
Fuel Combustion	2.8	33.4	77.4	10.7	3.9
Waste Disposal	7.1	0.1	0.1	0.0	0.0
Cleaning and Surface Coating	71.0	0.0	0.0	--	0.0
Petroleum Production and Marketing	33.3	1.2	8.7	36.5	1.2
Industrial Processes	11.0	0.7	3.0	7.5	12.2
Subtotal	**125.2**	**35.4**	**89.2**	**54.7**	**17.3**
Areawide Sources					
Solvent Evaporation	74.6	--	--	--	--
Miscellaneous Processes	15.6	169.0	17.1	1.4	130.1
Subtotal	**90.2**	**169.0**	**17.1**	**1.4**	**130.1**
Mobile Sources					
On-Road Motor Vehicles	255.1	2,149.6	273.6	4.9	8.5
Other Mobile Sources	63.7	513.3	178.1	31.4	12.4
Subtotal	**318.8**	**2,662.9**	**451.7**	**36.3**	**20.9**
Total for the Air Basin	**534.2**	**2,867.3**	**558.0**	**92.4**	**168.3**

Source: California Air Resources Board 2001b.

11.1.4 Project Setting

This section provides information on the physical setting and the available air quality information for the project area.

11.1.4.1 Topography and Meteorology

Atmospheric conditions such as wind speed and direction, air temperature gradients, and local and regional topography influence air quality. The SFBAAB, of which Napa and Marin Counties and the southeast portion of Sonoma County are a part, ~~is affected by~~ has a Mediterranean climate of warm, dry summers and cool, damp winters. During the summer, maximum temperatures are about 64$^{?}$F along the coast, and about 88$^{?}$F farther inland. In winter, average minimum temperatures are in the low to mid-40s along the coast and in the low to mid-30s inland.

Topographical features, the location of the Pacific high pressure system, and varying circulation patterns resulting from temperature gradients affect the speed and direction of local winds. The winds play a major role in the dispersion of pollutants. Strong winds can carry pollutants far from their source; a lack of wind will allow pollutants to concentrate in an area. Wind patterns in Napa, Sonoma, and Marin Counties are affected by the Bolinas Ridge along the coast, Big Rock Ridge south of Novato, and the Sonoma Mountains to the north.

Air dispersion also affects pollutant concentrations. As altitude increases, air temperature normally decreases. Inversions occur when colder air becomes trapped below warmer air, restricting the air masses' ability to mix. Pollutants also become trapped, which promotes the production of secondary pollutants. Subsidence inversions, which can occur during the summer in the SFBAAB, result from high-pressure cells that cause the local air mass to sink, compress, and become warmer than the air closer to the earth. Pollutants accumulate as this stagnating air mass remains in place for 1 or more days.

11.1.4.2 Existing Air Quality Conditions

Based on data from three monitoring stations in the vicinity of the project area, e~~E~~xisting air quality in the project area is excellent, with only a few exceedances of state air quality standards between 1998 and 2000. Existing air quality conditions for criteria pollutants O_3, CO, NO_2, SO_2, and PM10 are shown in Table 11-3. No exceedances of the state or federal air quality standards were recorded for CO, NO_X, or SO_2. PM10 state standards were exceeded at ~~both~~ the Napa, San Rafael, and Vallejo stations. At the Napa station, there was one exceedance of the annual geometric mean concentration in 1998, two exceedances in 1999, and no exceedances in the year 2000.

Table 11-3. Summary of Ambient Air Quality in the Vicinity of the Napa River Unit

Pollutant	Monitoring Station	Time/Standard	1998	1999	2000
Ozone (0_3)	Napa	Peak 1-hour concentration (ppm)	0.13	0.12	0.08
		Days above federal standard	1	0	0
		Days above state standard	3	4	0
	Vallejo	Peak 1-hour concentration (ppm)	0.12	0.11	0.08
		Days above federal standard	0	0	0
		Days above state standard	3	4	0
	San Rafael	Peak 1-hour concentration (ppm)	0.06	0.08	0.07
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
Carbon Monoxide (CO)	Napa	Peak 8-hour concentration (ppm)	3.9	4.2	2.8
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
	Vallejo	Peak 8-hour concentration (ppm)	5.3	2.9	5.1
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
	San Rafael	Peak 8-hour concentration (ppm)	3.3	2.9	2.3
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
Nitrogen Dioxide (NO_2)	Napa	Peak 1-hour concentration (ppm)	0.06	0.09	0.05
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
	Vallejo	Peak 1-hour concentration (ppm)	0.06	0.08	0.06
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
	San Rafael	Peak 1-hour concentration (ppm)	0.06	0.09	0.06
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
Sulfur Dioxide (SO_2)	Napa	Peak 24-hour concentration (ppm)	-	-	-
		Days above federal standard	-	-	-
		Days above state standard	-	-	-
	Vallejo	Peak 24-hour concentration (ppm)	0.006	0.007	0.005
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
	San Rafael	Peak 24-hour concentration (ppm)	-	-	-
		Days above federal standard	-	-	-
		Days above state standard	-	-	-

Pollutant	Monitoring Station	Time/Standard	1998	1999	2000
PM10	Napa	Annual geometric mean (μg/m^3)	15.6	16.3	14.7
		Days above federal standard	0	0	0
		Days above state standard	1	2	0
		Peak 24-hour concentration (μg/m^3)	-	66	45
		Days above federal standard	-	0	0
		Days above state standard	-	2	0
	Vallejo	Annual geometric mean (μg/m^3)	15.0	16.4	13.0
		Days above federal standard	0	0	0
		Days above state standard	1	3	1
		Peak 24-hour concentration (μg/m^3)	-	84	53
		Days above federal standard	-	0	0
		Days above state standard	-	3	1
	San Rafael	Annual geometric mean (μg/m^3)	18.7	19.5	18.2
		Days above federal standard	0	0	0
		Days above state standard	0	0	0
		Peak 24-hour concentration (μg/m^3)	52	76	40
		Days above federal standard	-	0	0
		Days above state standard	-	1	0

Source: BAAQMD 1998, 1999, 2000 Internet Air Quality Data Summaries

Notes: ppm = parts per million; μg/m^3 = micrograms per cubic meter; pphm = parts per hundred million, ppb = parts per billion

PM10 = particulate matter under 10 micrometers in diameter

Pollutant standards listed as follows (state, federal): Ozone 1 hour peak (9pphm, 12 pphm); CO 8 hour (20 ppm, 35 ppm); NO2 1 hour (25 pphm, na) annual (na, 5.3 pphm); SO2 24 hour (40 ppb, 140 ppb); PM10 annual geometric mean (30 ppm, na) 24 hour (50 ppm, 150 ppm).

Monitoring of the peak 24-hour concentrations at the Napa station began in 1999. That year there were two exceedances of the peak 24-hour concentrations at the Napa station; no exceedances were recorded in the year 2000. The data for the Vallejo station follow a similar pattern, with one exceedance of the annual standard in 1998, three exceedances of the annual standard in 1999, and one exceedance of the annual standard in the year 2000. Monitoring of the 24-hour peak concentration also began in 1999 at the Vallejo station; the number of exceedances of the peak 24-hour standard are the same as for the annual standard. The only PM10 exceedance at the San Rafael station was for the 24-hour peak concentration (one exceedance in 1999).

O_3 was the only constituent that exceeded federal as well as state standards. The 1998 O_3 data for Napa show one day when the peak 1-hour O_3 concentration exceeded the federal standard. There were no exceedances of the federal standard at the Vallejo station, nor at the Napa station in 1999 or 2000. There were 3 exceedances of the state peak 1-hour standard at both Napa and Vallejo in

1998, and 4 exceedances at both stations in 1999. The state O_3 standard was not exceeded in 2000.

Sampling data from the Napa and Vallejo regional air monitoring stations were obtained from BAAQMD and evaluated for seasonal trends. In general, higher concentrations of NO, CO, and particulate matter were detected between January and March as well as between October and December. The SO_2 concentrations remained at a nearly constant level throughout the entire year.

11.1.4.3 Current Emissions

Napa River Unit

As described in Chapter 2, DFG is currently conducting limited maintenance ~~activity~~ activities in the Napa River Unit. This activity includes monitoring pond conditions, managing water control structures, pumping water ~~into the ponds when possible~~from Pond 1 to Pond 2, and inspecting levees. These activities generate air emissions, primarily associated with levee maintenance, as well as transportation (by pickup truck or small boat) around the project area. ~~The pump providing Napa River water to the project area is electrically powered, and thus does not generate emissions~~. The only other current source of emissions is limited recreational traffic (i.e., personal vehicle traffic and small boat traffic).

Water Deliver Project and Program Component Areas

The routes of the pipelines proposed under the Project Component of the Water Delivery Option are generally undeveloped or rural, and there are no major air pollutant emitters in the local area. The Sonoma Pipeline is proposed along a route that is bordered by a wildlife refuge to the south and vineyards and pasture to the north. The routes of the proposed Napa and CAC Pipelines are bordered largely by pasture, undeveloped open space, vineyard, and rural residential development. Vehicle traffic on Green Island Road, along which a portion of the CAC Pipeline would extend, is not considered to be a major source of air pollutant emissions. The Napa County Airport is just north of the CAC Pipeline alignment. Given the relatively small size and nature of the airport, operation of the facility is not considered to be a major source of air pollutant emissions.

Portions of the routes of the other future pipelines considered under the Program Component of the Water Delivery Option extend through developed areas that likely include various sources of emissions, particularly in industrial areas. Additionally, vehicle traffic along U.S. 101, a major transportation corridor, is considered to be a notable source of air pollutant emissions in the local area. Sears Point Raceway is another notable source of vehicular emissions (when race events occur).

There are relatively few sensitive receptors (i.e., land uses that are particularly sensitive to air pollutant emissions such as residential development, schools,

hospitals, child care centers, etc.) in proximity to the currently proposed pipeline routes. There are scattered homes close to the Sonoma Pipeline (Figure 11-1), pockets of rural residential development located along the Green Island Road segment of the CAC Pipeline (Figure 11-2), and scattered homes along Buchli Station Road, Las Amigas Road, and Stanly Lane along the Napa Pipeline. Along the routes of the potential future pipelines, there is a mix of urban and rural uses that include sensitive receptors mainly in the form of existing residential development along Lakeville Road in Sonoma County as well as a public elementary school in proximity to U.S. 101 in Novato.

11.2 Environmental Impacts and Mitigation Measures

11.2.1 Methodology and Significance Criteria

This section describes the significance criteria and methodology used to evaluate the air quality impacts that could occur with implementation of each option. Impacts were analyzed for project-related emissions affecting the SFBAAB.

Air quality at a given location can be described by the concentrations of various pollutants in the atmosphere. The significance of a pollutant concentration was determined by comparing the concentration to an appropriate federal and/or state ambient air quality standard. The standards represent the allowable atmospheric concentrations at which the public health and welfare are protected and include a reasonable margin of safety to protect the more sensitive receptors in the population. Units of concentration are generally expressed in ppm or $\mu g/m^3$.

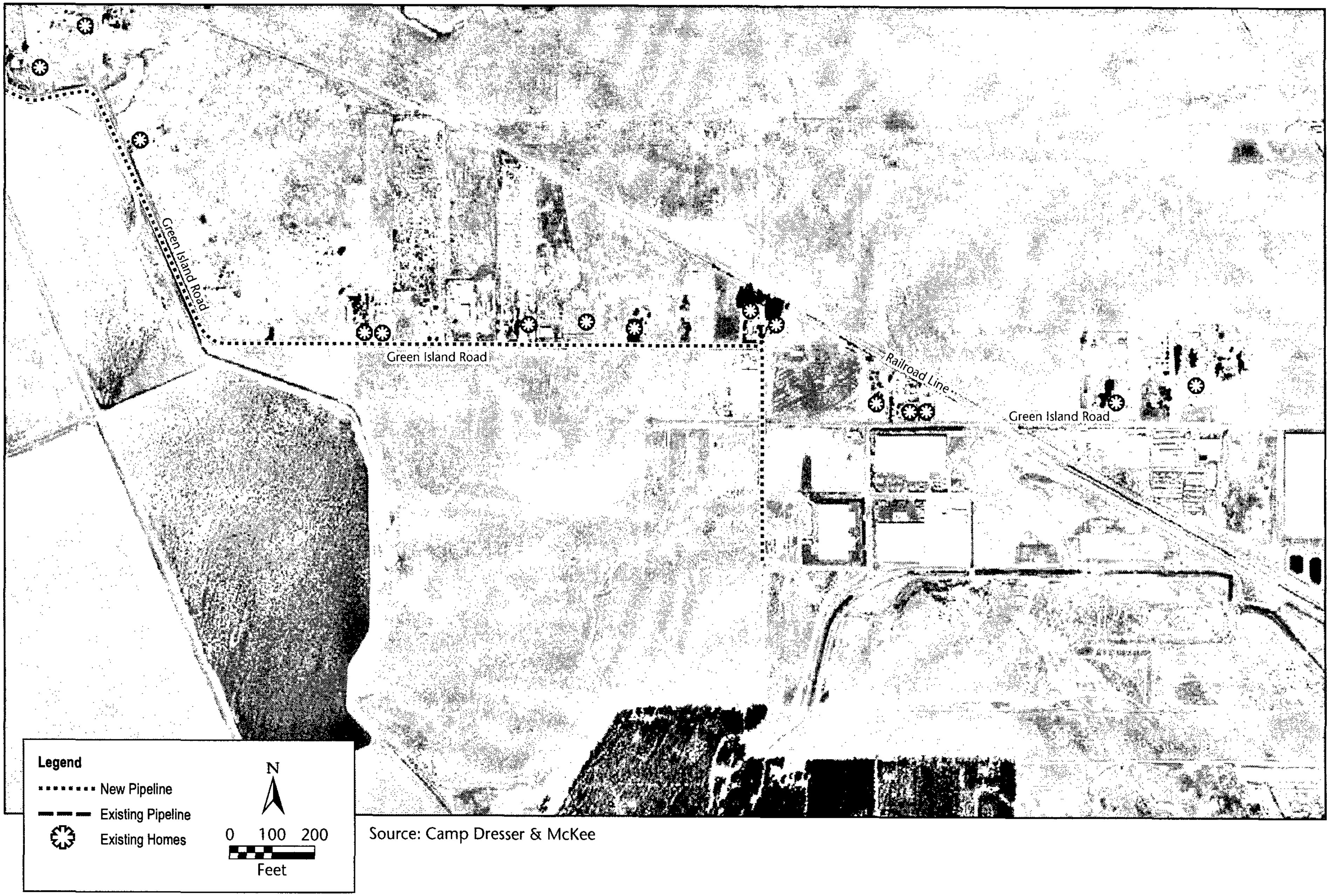
Criteria based on the CEQA Guidelines and federal, state, and local air pollution standards and regulations, as well as professional judgment, were used to determine the significance of air quality impacts. The project would have a significant impact on air quality if it would

- conflict with or obstruct implementation of applicable air quality plans;
- increase ambient pollutant levels from below to above the NAAQS or CAAQS;
- substantially contribute to an existing or projected air quality standard violation;
- exceed the following thresholds that BAAQMD defines as significant under CEQA for project operation activities: total emissions greater than 80 pounds per day or 15 tons per year of ROG, NO_x, PM10, or PM10 precursors, such as SO_x (BAAQMD 1996);
- expose sensitive receptors to substantial pollutant concentrations; or
- create objectionable odors affecting a substantial number of people.

Source: Camp Dresser & McKee

Jones & Stokes

Figure 11-1
Sensitive Receptors Adjacent to the Sonoma Pipeline



Source: Camp Dresser & McKee

01396.01

Jones & Stokes

Figure 11-2
Sensitive Receptors Adjacent to the CAC Pipeline

BAAQMD has not identified thresholds of significance for emissions from construction activities. Construction-related emissions are generally short-term in duration, but still may cause adverse air quality impacts. PM10 is generally the pollutant of greatest concern with respect to construction activities that disturb the ground surface (e.g., during installation of water conveyance features or levee repairs). Construction equipment emits CO and O_3 precursors; however, these emissions are included in the emission inventory that is the basis for regional air quality plans. These pollutants are therefore not expected to impede attainment or maintenance of the O_3 and CO standards in the Bay Area (BAAQMD 1996).

The primary issues addressed for air quality for this project are construction impacts and project conformity analysis. The construction impacts were determined by generating complete inventories of project emissions expected under each option. Included in the inventories are

- combustion emissions from equipment used in the installation of water conveyance equipment and its supporting equipment and levee repairs and upgrades,
- combustion emissions from all support and transport vessels (much of the equipment would have to be brought in by barge),
- combustion emissions from landside vehicles used for worker commute trips and material delivery trips, and
- fugitive dust emissions from ~~any~~ ground disturbance or stockpiling activities.

Most air emissions are assumed to cease at the end of the construction phase. There may be limited vehicular activity in the project area associated with maintenance and monitoring of the project, as well as with limited recreational use. Levee maintenance would be required for ponds that are retained as ponds. Under the No-Project Alternative, there could be fugitive dust generation as the ponds continue to dry out.

The evaluation of construction phase emissions considers the following factors:

- types and sizes of mobile equipment, vessels, and vehicles used;
- daily hours of operation;
- load factors of the engines;
- type(s) of fuel used;
- vessel and vehicle miles traveled;
- area of disturbed land surface; and
- schedule of activities (when the various activities would occur).

To the extent possible, these data were obtained from the Corps' preliminary engineering estimates for the project and options. Recreational user data and current maintenance activities are based on logs maintained by DFG and

described in Chapter 15, "Recreation, Public Access, Visual Resources, and Public Health." Future recreational use was projected based on the projected population increase in the Bay Area (Association of Bay Area Governments 2000). Where presently unknown or unavailable, data assumptions were developed to allow a reasonable worst-case analysis of potential impacts.

Emissions from construction equipment and vehicles were estimated using emission factors contained in EPA's *Compilation of Air Pollutant Emission Factors, Volumes I and II* (AP-42) (U.S. Environmental Protection Agency 1985 and 1996), EPA's *Nonroad Engine and Vehicle Emission Study-Report* (U.S. Environmental Protection Agency 1991), and the South Coast Air Quality Management District *CEQA Air Quality Handbook* (SCAQMD 1993). Vessel emission factors are from the document *Marine Vessel Emissions Inventory and Control Strategies* (Accurex Environmental Corporation 1996) and default marine engine emission factors used by the Carl Moyer Program (California Air Resources Board 2000). Motor vehicle emission factors were obtained from the CARB EMFAC7G emission factor program (California Air Resources Board 1997). Emission estimates are presented for the baseline (current levels), the various options, and the No-Project Alternative.

Section 176(c) of the CAA requires "applicable" federal projects to prepare a conformity determination to demonstrate that project activities would conform to the SIP's purpose of eliminating or reducing NAAQS violations and achieving attainment of such standards. The determination of whether the project falls into the category of an applicable project was performed as part of the ~~EIR~~EIS analysis. A conformity determination is not required if the applicability analysis determines that the project's direct and indirect emissions (1) do not exceed the conformity *de minimis* threshold levels, and (2) are less than 10% of the nonattainment/maintenance area's emissions for that pollutant. The conformity *de minimis* threshold level for a serious nonattainment area for O_3 precursors is 50 tons/year. Ten percent of the BAAQMD's emissions inventory for O_3 precursors for off-road equipment is approximately 12 tons/day (California Air Resources Board 2002).

Conformity thresholds are the levels of emissions that have been established by EPA for pollutants in nonattainment and maintenance areas. Emissions less than the conformity thresholds are assumed to conform to the SIP's purpose of eliminating or reducing the severity and number of NAAQS violations and achieving expeditious attainment of such standards. Projects with emissions greater than the thresholds have to demonstrate conformity by some other method as outlined in the final conformity rules developed by EPA in November 1993 (58 FR 63214). The total annual changes in future emissions, compared to baseline emissions, are used to determine the potential for exceeding the federal conformity thresholds.

Estimated project operating emissions were compared to the BAAQMD emission thresholds to determine whether significant impacts would occur. Where impacts from project activities were shown to be significant, appropriate mitigation measures have been identified to reduce the impacts, where feasible. However,

given the low intensity of use of the project site during the operations phase, emissions are correspondingly low.

Project-related emissions would be primarily direct impacts from construction. Emissions include exhaust from construction equipment, fugitive dust from construction activities, and exhaust from worker vehicle trips to and from the site.

To determine the exhaust emissions related to off-road construction equipment, the construction equipment was inventoried; total hours necessary for each piece of equipment for project completion were determined; and total hours were multiplied by the average horsepower and the load and emission factors for each piece of equipment to determine the total pollutants per year (California Air Resources Board 2001a).

11.2.1.1 Air Emissions Associated with Use of Explosives

There are hundreds of different explosives, with no universally accepted system for classifying them. The classification used in Table 11-4 is based on the chemical composition of the explosives, without regard to other properties, such as rate of detonation, that relate to the applications of explosives but not to their specific end products. Most explosives are used in two-, three-, or four-step trains. A simple removal of a tree stump might be completed using a two-step train made up of an electric blasting cap and a stick of dynamite. To make a large hole in the earth, an inexpensive explosive such as ammonium nitrate with 5.3–8% fuel oil (ANFO) might be used.

CO is the pollutant produced in greatest quantity from explosives detonation. Trinitrotoluene (TNT), an oxygen-deficient explosive, produces more CO than most dynamites, which are oxygen-balanced; however, all explosives produce measurable amounts of CO. Particulates are produced as well, but such large quantities of particulates are generated in the shattering of rock and earth by the explosive that the quantity of particulates from the explosives charge itself cannot be distinguished. Nitrogen oxides (both nitric oxide [NO] and NO_2) are formed, but only limited data are available on these emissions. Oxygen-deficient explosives are said to produce little or no nitrogen oxides, but there is only a small body of data to confirm this.

Emissions from explosives detonation are influenced by many factors such as explosive composition, product expansion, method of priming, length of charge, and confinement. These factors are difficult to measure and control in the field and almost impossible to duplicate in a laboratory test facility. Any estimates of emissions from explosive use must be regarded as approximations and cannot be made more precise because explosives are not used in a precise, reproducible manner.

Table 11-4. Composition, Uses, and Emission Factors of Various Explosives

			Emission Factor (lb/ton)*				
Explosive	Composition	Uses	Carbon Monoxide (CO)	Nitrogen Oxides[a] (NO_x)	Methane[b]	Hydrogen sulfide (H_2S)	Sulfur Dioxide (SO_2)
Black Powder	75/15/10: Potassium (sodium) nitrate/ charcoal/sulfur	Delay fuses	170 (76–240)	ND	4.2 (0.6–9.7)	24 (0–73)	NA
Smokeless powder	Nitrocellulose (sometimes with other materials)	Small arms, propellant	77 (68–84)	ND	1.1 (0.7–1.5)	21 (20–21)	NA
Dynamite, straight	20–60% sodium nitrate/wood pulp/calcium carbonate	Rarely used	281 (87–524)	ND	2.5 (0.6–5.6)	6 (0–15)	NA
Dynamite, ammonia	20–60% Nitroglycerine/ ammonium nitrate/sodium nitrate/wood pulp	Quarry work, stump blasting	63 (46–128)	ND	1.3 (0.6–2.1)	31 (19–37)	NA
Dynamite, gelatin	20–100% Nitroglycerine	Demolition, construction work, blasting in mines	104 (26–220)	53 (8–119)	0.7 (0.3–1.7)	4 (0–6)	1 (1–16)
ANFO	Ammonium nitrate with 5.8–8% fuel oil	Construction work, blasting in mines	67	17	ND	NA	2 (1–3)
TNT	Trinitrotoluene	Main charge in artillery projectiles, mortar rounds, etc.	796 (647–944)	ND	14.3 (13.2–15.4)	NA	NA
RDX	$(CH_2)_3N_3(NO_2)_3$ Cyclotrimethylene-tetranitrate	Booster	196[c] (5.6–554)	ND	ND	NA	NA
PETN	$C(CH_2ONO_2)_4$ Pentaerythritol tetranitrate	Booster	297 (276–319)	ND	ND	NA	NA

*Units are in pounds per ton of explosive used.
ND = No data; NA = Not applicable; lb/ton = pounds per ton
[a]Based on experiments carried out prior to 1930 except in the cases of ANFO, TNT, and PETN.
[b]The factors apply to the chemical species, methane. They do not represent total volatile organic compounds expressed as methane. Studies were carried out more than 40 years ago.
[c]These factors are derived from theoretical calculations, not from experimental data.

The primary constituent of concern associated with the use of explosives for levee breaching would be particulate matter (i.e., the dust that is generated when the explosives are detonated). There is no effective way of quantifying the amount of dust generated.

11.2.2 No-Project Alternative

Air emissions would occur under the No-Project Alternative as a result of ongoing levee maintenance and water control structure repair (Table 11-5). The air emissions under the No-Project Alternative are associated with levee maintenance (approximately 64% of total emissions), the repair of water control structures (approximately 20% of total emissions), and other activities (approximately 16% of total emissions). Levee maintenance is assumed to be an ongoing activity, with an average of 2.6 days of levee maintenance per year for the 50-year project life. Although these emissions would occur as a part of ongoing DFG activities, they are construction-related emissions that would be subject to BAAQMD dust control measures. These measures are described in Chapter 2, "Site Description and Options."

Table 11-5. Criteria Pollutants for the Project Area Projected by Alternative

	Total Tons Over 50 Years [1]					
Alternative	NO_x	ROG	CO	SO_x	PM	PM10
No-Project Alternative [2]	11.4	0.8	6.1	3.7	0.40	0.39
Salinity Reduction Option 1A	14.3	0.8	4.7	3.0	0.53	0.51
Salinity Reduction Option 1B	10.8	0.6	3.8	2.5	0.38	0.37
Salinity Reduction Option 1C	9.9	0.5	3.6	2.4	0.34	0.33
Salinity Reduction Option 2	13.3	0.7	4.5	2.8	0.5	0.48
Water Delivery Option [3]						
Project Component	-	-	-	-	-	-
Program Component	-	-	-	-	-	-
Habitat Restoration Option 1	43.5	2.5	15.6	9.2	1.7	1.6
Habitat Restoration Option 2	37.1	2.2	13.8	8.5	1.4	1.3
Habitat Restoration Option 3	44.8	2.6	16	9.5	1.8	1.7
Habitat Restoration Option 4	48.9	2.6	16.3	10.3	1.8	1.7

	Total Tons per Year [1]					
Alternative	NO_x	ROG	CO	SO_x	PM	PM10
No-Project Alternative [2]	0.23	0.02	0.12	0.07	0.01	0.01
Salinity Reduction Option 1A	0.29	0.02	0.09	0.06	0.01	0.01
Salinity Reduction Option 1B	0.22	0.01	0.05	0.05	0.01	0.01
Salinity Reduction Option 1C	0.20	0.01	0.07	0.05	0.01	0.01
Salinity Reduction Option 2	0.27	0.01	0.09	0.06	0.01	0.01

Alternative	Total Tons per Year [1]					
	NO_x	ROG	CO	SO_x	PM	PM10
Water Delivery Option [4]						
Project Component	32.94	4.08	13.88	NA	NA	1.33
Program Component [5]	NA	NA	NA	NA	NA	NA
Habitat Restoration Option 1	0.87	0.05	0.31	0.18	0.03	0.03
Habitat Restoration Option 2	0.74	0.04	0.28	0.17	0.03	0.03
Habitat Restoration Option 3	0.90	0.05	0.32	0.19	0.04	0.03
Habitat Restoration Option 4	0.98	0.05	0.33	0.21	0.04	0.03

Notes:

[1] Tons of emissions are total emissions over the life of the option—annual emissions are a fraction of the total emissions.

[2] No-Project and baseline emissions are assumed to be the same.

[3] All impacts happen in first year and do not occur over 50 years.

[4] Combined emissions from Sonoma, CAC, and Napa segments.

[5] Pollutant emissions for the Program Component would be construction-related only. Exact alignments have not been chosen; therefore, at this time construction emissions are unknown.

Project-related emissions would be well below the conformity thresholds, would not conflict with air quality plans, and would not exceed BAAQMD thresholds. Thus, potential impacts under the No-Project Alternative are limited to those resulting from the desiccation of the ponds.

11.2.2.1 Impact AQ-1: Increase in Fugitive Dust Emissions Resulting from Increased Desiccation of the Ponds

Under the No-Project Alternative, because of the limited availability of water and deteriorating water conveyance infrastructure, Ponds 3, 4, 5, 6, 6A, and 7A would eventually become dry salt flats during a portion of the year. Pond 7, the bittern pond, is hygroscopic and thus unlikely ever to dry out completely. Existing water control structures for Ponds 1, 1A, 2, and 8 will help limit salinity increases in these ponds and prevent them from drying out. Observations of ponds that have dried out in the past indicate that the salts in the ponds form a hard crust that is resistant to windborne dispersion. Unless this crust is disturbed by significant human activity, such as construction, it is unlikely that desiccation of the ponds would result in the generation of irritant dust. Construction activities under the No-Project Alternative would be limited to minimum maintenance of levees and maintenance of water control structures, and would generally not affect any salt crusts. Construction activities would not typically affect the salt crusts; therefore, this impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

11.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

The potential air quality impacts associated with the project are similar for all salinity reduction, water delivery, and habitat restoration options, with the main differences being the intensity of each impact for each option. The impacts are generally associated with

- construction activities (all construction activities would generate emissions through vehicle emissions and fugitive dust generation);
- levee breaching (explosives would be used); and
- maintenance activities (which would be similar to, but generally less intensive than, the initial construction efforts).

11.2.3.1 Impact AQ-2: Increase in Ambient Pollutant Levels

Construction activities associated with Salinity Reduction Option 1A would include improvements to existing water conveyance structures, installation of new water conveyance and control structures, repairs and upgrades to existing levees, and long-term maintenance of levees and water conveyance/control structures for the upper ponds (i.e., the ponds with a long desalination period). Construction activities would also include breaching of interior levees with explosives. The exact type and quantity of explosive to be used is not known at this time, but it is likely that a material developed specifically for use in water would be selected.

Conventional construction activities would include the use of a variety of gasoline- and diesel-powered construction equipment. Estimated criteria pollutant emissions associated with Salinity Reduction Option 1A are shown in Table 11-5. Detailed calculations are provided in Appendix E. Because the BAAQMD dust control measures would be implemented as part of the project (see Chapter 2, "Site Description and Options"), emissions associated with construction are considered less than significant under CEQA. As can be seen from Table 11-5, total quantifiable emissions associated with Salinity Reduction Option 1A are also well below the federal conformity thresholds. This impact is considered less than significant. No mitigation is required.

11.2.3.2 Impact AQ-3: Potential Releases of Irritant Dust as a Result of Construction Activities

At ponds with existing salt crusts, construction activities may result in some of the salt crusts being pulverized by construction equipment. As a result, both on-site construction workers and nearby residents could be exposed to high levels of

irritant dust. This impact is considered significant. Implementation of Mitigation Measure AQ-1 would reduce this impact to a less-than-significant level. In addition, implementation of Mitigation Measures Haz-3, "Develop and Implement a Health and Safety Plan," and Haz-4, "Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8," would further reduce this impact. These measures are described in Chapter 9, "Hazards and Hazardous Materials."

Mitigation Measure AQ-1: Minimize Dust Generation in and Implement Dust Control Measures for Work Areas with Salt Crusts

To minimize the potential for disturbance of salt crusts, the contractor will be instructed to avoid disturbing the salt crusts, where possible. When work has to occur in areas with salt crusts, the contractor will conduct dust monitoring. If dust levels exceed the regulatory standard for nuisance dust, the contractor will implement dust control measures such as watering the work area and installing wind breaks. Specific acceptable dust control measures for salt crusts will be included in the contract specifications.

11.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts AQ-2 and AQ-3) are similar to those under Salinity Reduction Option 1A, although quantifiable emissions of NOx and CO would be lower. Estimated quantifiable emissions associated with Salinity Reduction Option 1B are shown in Table 11-5. Impact AQ-2 "Increase in Ambient Pollutant Levels" is slightly different and is described below.

11.2.4.1 Impact AQ-2: Increase in Ambient Pollutant Levels

~~Construction activities associated with Salinity Reduction Option 1B would include improvements to existing water conveyance structures, installation of new water conveyance and control structures, repairs and upgrades to existing levees, and long-term maintenance of levees and water conveyance/control structures for the upper ponds (i.e., the ponds with a long desalination period), and breach of interior Pond 4/5 levees and~~Construction activities for Option 1B are very similar to Option 1A; the difference is that instead of water control structures being installed in Pond 3, the exterior levee of Pond 3 would be breached. Explosives used to breach ~~these~~this area~~s~~ would result in an instantaneous localized increase in PM10 that would dissipate shortly after the explosion.

~~Conventional construction activities would include the use of a variety of gasoline- and diesel-powered construction equipment. Estimated criteria~~Quantifiable estimated criteria pollutant emissions associated with Salinity Reduction Option 1B are shown in Table 11-5 and are slightly lower than for Option 1A. Detailed calculations are provided in Appendix E. ~~Because the BAAQMD dust control measures would be implemented as part of the project (see Chapter 2, "Site Description and Options"), emissions associated with construction are considered less than significant under CEQA.~~ As can be seen from Table 11-5, total quantifiable emissions associated with Salinity Reduction Option 1B are also below the federal conformity thresholds. PM10 emissions will not conflict with air quality plans, substantially contribute to an existing air quality standard violation, or expose sensitive receptors to substantial pollutant concentrations. This impact is considered less than significant. No mitigation is required.

11.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts AQ-2 and AQ-3) are similar to those under Salinity Reduction Option 1A, although emissions of NO_x and CO would be lower. Estimated quantifiable emissions associated with Salinity Reduction Option 1C are shown in Table 11-5. Impact AQ-2 "Increase in Ambient Pollutant Levels" is slightly different and is described below.

11.2.4.1 Impact AQ-2: Increase in Ambient Pollutant Levels

~~Construction activities associated with Salinity Reduction Option 1C would include improvements to existing water conveyance structures, installation of new water conveyance and control structures, repairs and upgrades to existing levees, long-term maintenance of levees and water conveyance/control structures for the upper ponds (i.e., the ponds with a long desalination period), and breach of interior Pond 4/5 levees~~ Construction activities for Option 1C are similar to those for Option 1A. The difference is that instead of water control structures being installed in Ponds 3, 4, and 5, ~~and~~ the exterior levee of Ponds 3 and 4 would be breached. Explosives used to breach these areas would result in an instantaneous localized increase in PM10 that would dissipate shortly after the explosion.

~~Conventional construction activities would include the use of a variety of gasoline- and diesel-powered construction equipment.~~ Quatifiable e~~E~~stimated criteria pollutant emissions associated with Salinity Reduction Option 1C are shown in Table 11-5 and are slightly lower than for Salinity Reduction Option 1A. Detailed calculations are provided in Appendix E. ~~Because the BAAQMD dust control measures would be implemented as part of the project (see Chapter~~

~~2, "Site Description and Options"), emissions associated with construction are considered less than significant under CEQA.~~ As can be seen from Table 11-5, total quantifiable emissions associated with Salinity Reduction Option 1~~B~~C are also below the federal conformity thresholds. PM10 emissions will not conflict with air quality plans, substantially contribute to an existing air quality standard violation, or expose sensitive receptors to substantial pollutant concentrations. This impact is considered less than significant. No mitigation is required.

11.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Impacts AQ-2 and AQ-3) are nearly the same as those under Salinity Reduction Option 1A, although emissions would be somewhat higher. Estimated quantifiable emissions associated with Salinity Reduction Option 2 are shown in Table 11-5, and are well below conformity thresholds.

11.2.7 Water Delivery Option

11.2.7.1 Impact AQ-2: Increase in Ambient Pollutant Levels

Water Delivery Project Component

The construction of the Sonoma, CAC, and Napa Pipelines could pose the potential for an increase in ambient pollutant levels. The operation of the pipelines would not increase ambient pollutant levels because operation would ~~require the addition of a~~ include a new electrically powered pump station; the indirect emissions associated with the electricity consumed by the pump motor~~s~~ is~~are~~ considered negligible.

Construction of the Sonoma, CAC, and Napa Pipelines is not expected to have any long-term effects on air quality. However, construction would result in two types of short-term effects on air quality. These direct effects are combustion emissions and dust emissions. The two main criteria pollutants that would be generated during construction are NO_x associated with diesel motor exhaust and PM10 associated with fugitive dust and diesel exhaust. A description of the impacts associated with generation of these air pollutants during construction follows.

The Sonoma Pipeline route includes construction of approximately 8~~6.5~~ miles of new pipeline and one~~two~~ new pump stations. Compactors, excavators, front-end loaders, cranes, and generators would be used to construct the pipeline. Paving equipment, including pavers and rollers, would also be used minimally to repave two roadways.

Under conformity guidelines, the project would have to produce more than 50 tons/year of NO_x to trigger a conformity determination. Construction-related emissions for the Sonoma Pipeline would produce a total of approximately 14.7 tons/year of NO_x, construction of the Napa Pipeline would produce a total of approximately 10.9 tons/year of NO_x, and construction of the CAC Pipeline would generate approximately 7.3 tons of NO_x per year. Even if all three pipeline segments are constructed in the same year, the total NO_x emissions would be ~~substantially~~ less than the *de minimis* standard. Table 11-5 shows the combined NO_x total from the construction of the Sonoma, CAC, and Napa Pipelines.

Dust emissions would be generated, especially during dry conditions, because of excavation, stockpiling, and transportation of soils. It is anticipated that, using an open-trench pipeline construction method, three crews working simultaneously would place pipeline in segments approximately 300–400 feet long. Assuming a construction corridor width of approximately 30 feet, this would produce a construction activity area of approximately 9,000–12,000 square feet, or approximately 0.21–0.28 acre. Based on a fugitive dust emission factor of 55 pounds per day of PM10 per graded acre per day (SCAQMD 1993), pipeline construction activities would produce approximately 12–15 pounds per day of PM10. ~~Implementation of dust control measures would reduce fugitive dust emissions by approximately 50% and would be considered sufficient by BAAQMD to render the impact less than significant.~~

~~The CAC Pipeline route includes construction of 2.8 miles of new pipeline. Compactors, excavators, front-end loaders, cranes, and generators would be used to construct the pipeline. Paving equipment, including pavers and rollers, would also be used minimally to repave two roadways.~~

~~Under conformity guidelines, the project would have to produce less than 50 tons/year of NO_x to avoid triggering a conformity determination. Construction-related emissions for the CAC Pipeline would produce a total of 7.3 tons/year of NO_x, substantially less than the *de minimis* standard. Table 11-5 includes the combined NO_x total from the construction of the Sonoma, CAC, and Napa Pipelines.~~

As described above for the Sonoma Pipeline alignment, dust emissions would be generated during construction of the CAC Pipeline. It is anticipated that, using an open-trench pipeline construction method, two crews working simultaneously would place pipeline in segments approximately 200–300 feet long. Assuming a construction corridor width of approximately 30 feet, this would produce a construction activity area of approximately 6,000–9,000 square feet, or approximately 0.14–0.20 acre. ~~Based on a fugitive dust emission factor of 55 pounds per day of PM10 per graded acre per day (SCAQMD 1993), p~~ Pipeline construction activities would produce approximately 8–11 pounds per day of PM10. Assuming a -1-year construction period, this would be 2.9–4 tons. ~~Implementation of dust control measures would reduce fugitive dust emissions by approximately 50%. Use of control measures is considered sufficient by BAAQMD standards to render the impact less than significant.~~

~~The Napa Pipeline route (both segments) includes construction of approximately 4.2 miles of new pipeline. Compactors, excavators, front-end loaders, cranes, and generators would be used to construct the pipeline. Paving equipment, including pavers and rollers, also would be used to repave the roadways.~~

~~Under conformity guidelines, the project would have to produce less than 50 tons/year of NOx to avoid triggering a conformity determination. Construction-related emissions for the Napa Pipeline would produce a total of approximately 10.9 tons/year of NOx, substantially less than the de minimis standard.~~

Dust emissions would be generated, especially during dry conditions, because of excavation, stockpiling, and transportation of soils. Pipeline construction would be similar to that described above for the CAC Pipeline. Given a similar construction corridor, construction activities for the Napa Pipeline would also produce 8–11 pounds per day of PM10.

Implementation of dust control measures would reduce fugitive dust emissions from all pipeline segments by approximately 50%. Use of control measures is considered sufficient by BAAQMD standards to render the impact less than significant.

In summary, construction of the Project Component of the Water Delivery Option would result in short-term increases in NO_x as well as other criteria pollutants. BAAQMD has incorporated construction emissions into its emissions inventory, which is the basis for the regional air quality plan. This impact is considered less than significant. No mitigation is required. Similarly, BAAQMD dust control measures would be implemented; therefore, although there would be a temporary increase in dust, this impact is also considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that potential impacts on air quality would be comparable to those described above for the Project Component (i.e., construction of the pipelines that comprise the Program Component would likely use open-trench methods). Depending on the length of the pipeline construction and the availability of any existing pipelines, the amount of construction and therefore the amount of emissions may be slightly increased or decreased as compared to the Project Component. Impacts on air quality from implementation of the Program Component would be over several months and would also include the implementation of BAAQMD dust suppression methods. Therefore, this impact is considered less than significant. No mitigation is required.

11.2.7.2 Impact AQ-4: Public Exposure to Substantial Pollutant Concentrations

Water Delivery Project Component

The construction of the Sonoma Pipeline would have the potential to affect sensitive air receptors (especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) because of emissions, with the greatest impact resulting from dust emissions. The closest receptors are homes along Burndale Road and south of SR 12/121 near 8th Street East, approximately 300 feet to 0.25 mile from the construction corridor. Fugitive dust generation associated with proposed construction activities is anticipated to be relatively minor (i.e., approximately 12–15 pounds per day). Assuming a 120-day construction period, this would be less than 1 ton of these emissions, not all of which would be adjacent to sensitive receptors. Additionally, fugitive dust impacts on nearby residents would be temporary and short-term. This impact is considered less than significant. No mitigation is required.

Dust generated from construction of the Napa and CAC Pipelines could affect sensitive air receptors located along the construction corridor. As stated above for the Sonoma Pipeline, fugitive dust generation associated with proposed construction activities is anticipated to be relatively minor and short-term. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that the daily construction-related air pollutant emissions associated with each of the potential future pipelines would be generally comparable to those described above for the Project Component. Based on preliminary alignment configurations, construction corridors would border commercial, agricultural, residential, and industrial areas. Depending on the exact alignment, there may be a lower or higher number of sensitive air receptors. Given the relatively low levels and temporary/transitory nature of the construction-related emissions, impacts on sensitive receptors are anticipated to be less than significant. No mitigation is required.

11.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

The types of activities potentially generating emissions under the habitat restoration options are similar to those under the salinity reduction options. The impact under Habitat Restoration Option 1 is nearly the same as that under Salinity Reduction Option 1A for Impact AQ-3. Impact AQ-2 is slightly different and is described below.

Conventional construction activities associated with Habitat Restoration Option 1 would include repairs to water conveyance structures, removal of existing water conveyance and control structures, repairs of levees, and long-term maintenance of levees and water conveyance/control structures for the ponds that are retained as ponds. No new water control/conveyance structures are anticipated as part of the habitat restoration options (i.e., it is assumed that all necessary water control/conveyance structures would have been installed as part of the salinity reduction effort). Similarly, all levees would have been upgraded as necessary during the salinity reduction phase, so that only maintenance is required for those levees that are required for the long term. Breaching of exterior levees with explosives (for those ponds opened to substantial tidal action) is discussed below.

Levee breaches for habitat restoration would be more extensive than levee breaches required during desalination. Under Habitat Restoration Option 1, exterior levee breaches are required for Ponds 3 and 4/5, as well as potentially for Pond 6/6A. Some of these levee breaches would be along the Napa River; others would be in the less accessible sloughs. Except where removal of water control structures results in a sufficiently large levee breach for habitat restoration purposes, external levee breaches would most likely be accomplished using explosives. Detonation of the explosives would result in both fugitive dust generation and release of chemical byproducts from blasting.

The exact type and quantity of explosive to be used is not known at this time, but it is likely that a material developed specifically for use in water would be selected.

11.2.8.1 Impact AQ-2: Increase in Ambient Pollutant Levels

Conventional construction activities would include the use of a variety of gasoline- and diesel-powered construction equipment. Estimated criteria pollutant emissions associated with Habitat Restoration Option 1 are shown in Table 11-5. Detailed calculations are provided in Appendix E. Although these emissions would occur during the operational phase of the project, they are construction-related emissions. Because BAAQMD's dust control measures would be implemented as part of the project, these quantifiable emissions are not considered to be significant under CEQA. As can be seen from Table 11-5, total quantifiable emissions associated with Habitat Restoration Option 1 are also well below the federal conformity thresholds. Explosives used to create the habitat restoration levee breaches would result in an instantaneous localized increase in PM10 that would dissipate shortly after the explosion. PM10 emissions will not conflict with air quality plans, substantially contribute to an existing air quality standard violation, or expose sensitive receptors to substantial pollutant concentrations. This impact is considered less than significant. No mitigation is required.

11.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 (Impacts AQ-2 and AQ-3) are nearly the same as those under Habitat Restoration Option 1, except that there would be more conventional construction and exterior levee breaching initially than under Habitat Restoration Option 1. Estimated quantifiable emissions of criteria pollutants associated with Habitat Restoration Option 2 are shown in Table 11-5, and are well below the federal conformity thresholds. Detailed calculations are provided in Appendix E.

11.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts AQ-2 and AQ-3) are nearly the same as those under Habitat Restoration Option 1, except that there would be less conventional construction and fewer exterior levee breaches initially than under Habitat Restoration Option 1. Estimated quantifiable emissions of criteria pollutants associated with Habitat Restoration Option 3 are shown in Table 11-5, and are well below the federal conformity thresholds. Detailed calculations are provided in Appendix E.

11.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 (Impacts AQ-2 and AQ-3) are nearly the same as those under Habitat Restoration Option 1, except that there would be substantially more conventional construction initially than under Habitat Restoration Option 1. Exterior levee breaching requirements would be the same as for Habitat Restoration Option 1. Estimated quantifiable emissions of criteria pollutants associated with Habitat Restoration Option 4 are shown in Table 11-5, and are well below the federal conformity thresholds. Detailed calculations are provided in Appendix E.

Chapter 12
Noise

12.1 Environmental Setting

12.1.1 Introduction, Sources of Information, and Terminology

This chapter describes noise conditions in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information about noise in Napa, Sonoma, and Marin Counties was adapted from the Napa and Sonoma County General Plans and the Novato General Plan. Additional information was taken from the City of American Canyon General Plan EIR. State and local agencies have developed guidelines for evaluating land use compatibility under different sound-level ranges; "Regulatory Setting" below summarizes those guidelines at both the state and county level. "Regional Setting" and "Project Setting" describe existing noise conditions at and adjacent to the project site.

The following noise terminology is used in this chapter:

- *Noise*: Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- *Decibel* (*dB*): A unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.
- *A-Weighted Decibels* (*dBA*): An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- *Equivalent Sound Level* (L_{eq}): A logarithmic average of noise levels from all sources of noise in a given area over a stated period of time (e.g., 24 hours, 1 year).
- *Day-Night Equivalent Sound Level* (L_{dn}): A 24-hour average sound level with a 10-decibel "penalty" added to noise during the hours between 10 p.m. and 7 a.m. to account for the greater noise sensitivity of people at night.
- *Sensitive Receptor:* A population that is more susceptible to impacts than is the general population. Sensitive noise receptors include schools, residences, child care centers, health care facilities, and convalescent centers.

12.1.2 Regulatory Setting

In 1987, DHS published guidelines for the noise elements of local general plans. DHS has recognized the normally acceptable range for low-density residential uses, less than 65 dB L_{dn} and 55–70 dBA, as conditionally acceptable.

The Napa County Noise Ordinance states that residences in a rural area must not be exposed to noise levels greater than 45 dBA for more than half an hour between the hours of 10 p.m. and 7 a.m. Noise levels must not exceed 50 dBA L_{dn} between the hours of 7 a.m. and 10 p.m.

The county noise ordinance requires that construction activities begin no earlier than 7 a.m. and cease no later than 7 p.m. The ordinance also states that construction-related noise must not exceed 75 dBA in residential areas.

The noise element of the Sonoma County General Plan, as adopted in 1989 and revised in 1994, indicates that typical noise levels for sensitive areas range from 40 to 50 dB Ldn. Areas in Sonoma County are considered noise impacted if they are exposed to noise levels exceeding 60 dB L_{dn}. These thresholds pertain to an average noise level over a 24-hour period.

The Solano County General Plan also includes noise thresholds for permanent facilities and construction-related activities. The maximum allowable noise levels from construction equipment average 75 dBA at 50 feet.

The Novato General Plan was first adopted in 1996. It was updated in 1999 and 2001 to address new information and concerns regarding community noise exposure levels. The guidelines establish the following threshold outdoor noise levels.

- Up to 60 dB L_{dn} is normally acceptable for outdoor noise for residential developments, motels and hotels, schools, libraries, churches, hospitals, and nursing homes;
- up to 65 dB L_{dn} is normally acceptable for playgrounds, neighborhood parks, and open space; and
- up to 70 dB L_{dn} is normally acceptable for office buildings, golf courses, concert halls, cemeteries, and industrial and manufacturing sites.

These thresholds pertain to an average noise level over a 24-hour period.

12.1.3 Regional Setting

Although portions of Napa, Sonoma, Solano, and Marin Counties are urbanized, most of each county is generally considered rural. Ambient noise levels in urban areas typically range from approximately 60 to 70 dBA, and in rural areas from approximately 40 to 50 dBA. Major producers of noise in the counties include highway traffic, trains, planes, and industry-related machinery at various

industrial zones. Noise levels typically range from 25 dBA in rural areas to as high as 100 dBA in industrial areas. The counties have several noise-sensitive areas, including urban residential zones, schools, hospitals, and wildlife management areas.

12.1.4 Project Setting

12.1.4.1 Napa River Unit

The Napa River Unit is located in a rural area of Napa and Solano Counties. There are currently two major sources of noise near the project area. SR 37 borders the project area to the south, and the Napa County Airport is approximately 1.5 miles from the northeast corner of the project area. There are approximately 60 single-family homes along the eastern edge of Edgerley Island, immediately east of Pond 8. The nearest home is about 100 feet from Pond 8 and 1,200 feet from Ponds 7 and 7A. Homes in the Slaughterhouse Point neighborhood across the Napa River are approximately 1,000 feet from Pond 4. Because the project area is considered rural, the noise setting in the middle of the project area would most likely be between 25 and 35 dBA.

12.1.4.2 Water Delivery Project and Program Component Areas

The alignment of the Sonoma Pipeline, proposed as part of the Project Component of the Water Delivery Option, is located in a rural area of Sonoma County. The alignment is bordered primarily by a wildlife preserve, pasture, and vineyards to the south and vineyards and pasture to the north. Traffic noise from SR 12/121 and the Valley of the Moon Trap Club are the only significant noise sources in the immediate area. Although much of the Sonoma Pipeline alignment occurs within the NWPRA's ROW, the subject rail line is not currently in service. Napa County Airport is located a couple of miles east of the alignment. There are a few scattered homes along Ramal Road north of the alignment. Additionally, there are homes north of the alignment on Burndale Road and south of SR 12/121 near 8th Street East. The nearest homes are approximately 300 feet to 0.25 mile from the alignment.

The proposed CAC Pipeline alignment extends along Green Island Road and Mezzetta Road. The two major noise sources in the area include Napa County Airport, located approximately 1 mile to the north, and SR 29, which runs perpendicular to the alignment to the east. Truck traffic along Green Island Road and minimal operations by the California Northern Railroad also add to the existing noise in the area. There are 15 homes along the north side of Green Island Road. The homes are set back from the road by approximately 50–200 feet.

The Napa Pipeline alignment extends along Buchli Station Road, Las Amigas Road, and Stanly Lane. The only major noise source in the area is the Napa County Airport, located approximately 3 miles southeast of Segment 1. There are scattered homes along these roadways that are set back from the road by approximately 50 feet to 200 feet.

The potential pipeline alignment that would bring water from the LGVSD and Novato SD WWTPs under the Program Component of the Water Delivery Alternative includes portions of U.S. 101, SR 37, and SR 121. Existing major noise sources in these areas include vehicle traffic on the highways and the Marin County Airport at Gnoss Field (north of Novato). Pockets of residential areas as well as industrial, recreational, and commercial areas frame the subject alignment.

The potential pipeline placement from the city of Petaluma would cross a rural area of Sonoma County. There are two major existing noise sources in the immediate area: Sears Point Raceway and Schellville Field (private airport). Napa County Airport is located about 15 miles east of the alignment and Marin County Airport at Gnoss Field is approximately 5 miles southwest of the alignment.

12.2 Environmental Impacts and Mitigation Measures

12.2.1 Methodology and Significance Criteria

Project-related noise effects were quantitatively evaluated by considering construction effects. To assess the effects of construction noise, typical construction noise levels were predicted and compared to the ambient noise level in the vicinity of the project area. Because potential changes or additions of water pumps or recreational activities are not expected to raise ambient noise levels for residents outside the project area, they were not evaluated in noise effects.

Criteria based on the noise ordinances found in the Napa, ~~and~~ Sonoma, and Solano County General Plans, the City of American Canyon General Plan EIR, and the Novato General Plan as well as the State CEQA Guidelines were used to determine the significance of noise impacts. The project would have a significant impact on noise if it would:

- increase ambient noise levels for sensitive receptors, thereby exceeding standards established in the local general plan or noise ordinance;
- result in a substantial permanent increase in ambient noise levels in the project vicinity above existing, no-project levels; or

- allow construction activities to occur at times other than between 7 a.m. and 7 p.m., or if during daytime hours noise levels would be perceived by the nearest resident as 75 dBA or higher.

The thresholds established by the Sonoma and Marin County General Plans pertain to a 24-hour average noise level, including the assignment of a penalty for noise occurring at night because of the more disturbing/intrusive nature of noise during that period. However, the project would not produce any notable operational noise; noise produced from construction would be short-term and only during daytime hours. As such, noise levels associated with construction activities cannot be compared to the L_{dn} thresholds.

Napa County, on the other hand, has established a construction-related noise threshold in addition to guidelines for long-term noise exposure. Since neither Sonoma nor Marin County has specific ordinances for construction-related noise, for the purposes of this ~~EIR/~~EIS, the construction-related thresholds listed in Napa County's noise ordinance were used for construction noise level significance determinations for all three counties.

Solano County has a list of maximum allowable noise levels from construction equipment. Maximum noise levels for most construction equipment is 75 dBA but up to 95 dBA is allowed for pile drivers.

Table 12-1 summarizes typical noise levels produced by construction equipment commonly used on construction projects. As indicated, equipment involved in construction is expected to generate noise levels ranging from ~~76~~55 dB to ~~89~~95 dB at a distance of 50 feet. Noise produced by construction equipment would be reduced at a rate of about 6 dB per doubling of distance.

Table 12-1. Noise Emission Levels of Construction Equipment

Equipment	Typical Noise Level (dBA) 50 Feet from Source
Long-reach excavator	85 [1]
Diesel-powered barges	85 [2]
Small to medium bulldozers	85
Dump trucks	84
Small clamshell dredge	80 [3]
Sheet pile driver	95
Crane	82
Front-end loader	80
Small boat	55 [4]

[1] Assumed same as Excavator.
[2] Assumed same as Dump Truck.
[3] Geier and Geier Consulting 1997.
[4] Assumed same as Pickup Truck.
Source: Thalheimer 1996.

A reasonable worst-case assumption is that the three loudest pieces of equipment would be operated simultaneously and continuously over a period of at least 1 hour. The combined sound level of three of the loudest pieces of equipment listed in Table 12-1 above (sheet pile driver, long-reach excavator, and a diesel-powered barge) is 96 dBA measured at 50 feet from the source. Table 12-2, which assumes this combined source level, summarizes predicted noise levels at various distances from an active construction site. These estimations of noise levels take into account attenuation (reduction in sound level) based on increasing distance, attenuation from molecular absorption, and anomalous excess attenuation (Hoover and Keith 1996).

Table 12-2. Estimated Construction Noise in the Vicinity of an Active Construction Site

Distance to Receptor (feet)	Sound Level at Receptor (dBA)	Comments
50	96	
100	90	
200	84	
300	80	
500	75	Significance threshold
750	71	Nearest residential area for Pond 8 improvements
1,000	68	
1,500	64	
2,000	61	
2,500	58	
3,000	55	Nearest residential area for most construction
4,000	51	
5,280	47	
7,500	40	

Notes:

The following assumptions were used:

Basic sound level dropoff rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	96 dBA
Distance for reference sound level:	50 feet

This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

12.2.2 No-Project Alternative

12.2.2.1 Impact N-1: Temporary Increase in Ambient Noise Levels as a Result of Emergency Repairs

Under the No-Project Alternative, limited levee reconstruction would occur in the event of the failure or catastrophic breach of the levees. The timing and duration of these reconstruction activities is unknown because it would depend on the extent of levee damage and the need for emergency repairs. However, emergency levee repairs could be expected to require equipment that could exceed county noise ordinance thresholds. Such equipment could produce approximately 90 dBA at residences on Edgerley Island if repair work is needed for Pond 8, and 55 dBA at residences in the Slaughterhouse Point neighborhood if work is needed on the northeast corner of Pond 3 or the east side of Pond 4. (The vandalism at Pond 3 will not be repaired because adverse effects are not anticipated and it is consistent with the general salinity reduction approach that

the project sponsors are pursuing.) The need to provide advance notice to neighbors and to ensure that equipment has appropriate sound-control devices could delay the ability to respond to needed emergency repairs. This impact is considered significant. Because this alternative would result in no project being implemented, no mitigation is required.

12.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

12.2.3.1 Impact N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction

Construction of facilities associated with this option would result in a temporary increase in ambient noise levels for residents on Edgerley Island and in Slaughterhouse Point neighborhoods. ~~Canal reconstruction adjacent to Pond 7 and i~~Installation of water control structures at Ponds 3, 4, 5, 7, 7A, and 8 would be the primary sources of noise related to construction activities. Each phase of construction is planned for a different time period~~:~~. ~~canal reconstruction at Pond 7 is expected to take approximately 3–4 weeks; and levee breaches between Ponds 4 and 5 are expected to be completed within 2 weeks of initiation~~.

Construction-related noise associated with ~~enlargement of the canal adjacent~~ mixing chamber improvements and construction of recycled water pipeline to Pond 7 are the main construction efforts at Ponds 7 and 7A. There will be installation of a water control structure at ~~ponds~~ Pond 8 near the Edgerley Island residences. In addition, levees at Ponds 7, 7A, and 8 will be repaired. ~~to Pond 7 would increase outside noise levels for the nearest residents~~. Because the nearest noise receptor is 750~~1,200~~ feet from a construction site, it is expected that outside noise levels in the nearest residential area could be as high as 71~~68~~ dBA (Table 12-2). This impact is considered less than significant because it does not violate the threshold level of 75 dBA for construction activities in a residential area as established by the Napa County Noise Ordinance.

Operation of water control structures at Ponds 7, 7A, and 8 is not expected to generate any appreciable noise. ~~and related water pumps at Ponds 7, 7A, and 8 could decrease as result of increased tidal influence on the project area. Because there would be no anticipated additional increase in noise effects, impacts associated with operation of existing pumps are considered to be less than significant.~~

This impact is considered less than significant. No mitigation is required.

12.2.3.2 Impact N-3: Temporary Increase in Noise Levels as a Result of Blasting Activities

Salinity Reduction Option 1A would also involve the use of explosives for breaching internal levees in the project area. Blasting of levees would result in a temporary increase in noise levels during daytime hours within the project area. A typical sound level for blasting, measured at 50 feet from the source, is 94 dBA (Hoover and Keith 1996). Table 12-3 shows estimated blasting noise levels in the vicinity of an active blasting site and lists the assumptions on which the noise-level calculations were based. As indicated in Table 12-3, the nearest sensitive receptors are approximately 1 mile from the proposed blasting location between Ponds 4 and 5. Because of the attenuation characteristics of such blasting activities, it is not expected that these residents would be exposed to increases in outside noise levels. This is also confirmed by DFG's experience with blasting the levee between Pond 4/5 and Pond 2A. This impact is considered less than significant. No mitigation is required.

Table 12-3. Estimated Blasting Noise in the Project Construction Area

Distance to Receptor (Feet)	Sound Level at Receptor (dBA)
50	94
100	88
200	82
400	75
600	71
800	69
1,000	66
1,500	62
2,000	59
2,500	56
3,000	53
4,000	49
5,280	45 (nearest residential area)
7,500	38

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Analogous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	94 dBA
Distance for reference sound level:	50 feet

12.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts N-2 and N-3) are nearly the same as those under Salinity Reduction Option 1A except that additional blasting would be required under this option.

12.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts N-2 and N-3) are nearly the same as those under Salinity Reduction Option 1A except that additional blasting would be required under this option. The option would require the most blasting, including approximately two more explosives charges, but this temporary short-term increase in noise is not expected to adversely affect nearby residents.

12.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Impacts N-2 and N-3) are nearly the same as those under Salinity Reduction Option 1A.

12.2.7 Water Delivery Option

12.2.7.1 Impact N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction

Water Delivery Project Component (Sonoma Pipeline)

Noise related to the construction of the Sonoma Pipeline would be caused by engine exhaust, fans, transmissions, and other mechanical equipment during the installation of the pipeline. A crane (82 dBA at 50 feet), excavator (84 dBA at 50 feet), and front-end loader (80 dBA at 50 feet) running simultaneously could produce peak construction noise levels of approximately 87 dBA at 50 feet. Sensitive receptors south of SR 12/121 near 8th Street East as well as the homes at the end of Burndale Road would be most affected by an increase in ambient noise levels because of their proximity to the construction area. If and when the three aforementioned types of construction equipment were operating simultaneously, the decibel range at this receptor would be 72 dBA. The noise level at the sensitive receptors would be less than the threshold for significance, which is 75 dBA. Therefore, this impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

Project-related construction noise along the Napa Pipeline would be caused by engine exhaust, fans, transmissions, and other mechanical equipment.

Commercial, industrial, and residential land uses border the proposed alignment with homes located within 50–200 feet of the construction zones. At this distance, the decibel range associated with the simultaneous operation of construction equipment (see above) would be approximately 75–87 dBA. This value represents a potential exceedance of the Napa County Noise Ordinance, which states that construction-related noise must not exceed 75 dBA in residential areas. In the short term, project-related construction noise would create noticeably higher ambient noise levels than currently exist at the sensitive receptors. This impact is considered significant. Implementation of Mitigation Measure N-1 would reduce this impact, but not to a less-than-significant level.

Mitigation Measure N-1: Decrease Noise Levels with Use of Noise Reduction Devices

The construction contractor will outfit and maintain construction equipment operating near noise sensitive receptors with noise-reduction devices such as high-efficiency mufflers to minimize construction noise. The use of noise-reduction devices will reduce noise by an average of 5–10 dBA at 50 feet. Wherever possible, noise-generating construction equipment will be shielded by the use of buffers such as structures or truck trailers. Such measures will reduce the predicted noise levels of 75–87 dBA associated with a scenario where three pieces of heavy-duty construction equipment are operating simultaneously.

Water Delivery Project Component (CAC Pipeline)

Project-related construction noise along the CAC Pipeline would be caused by engine exhaust, fans, transmissions, and other mechanical equipment. Primarily residential land uses border the proposed alignment with homes located within 50–200 feet of the construction zones. As stated above for the Napa Pipeline, at this distance, decibel ranges would exceed 75dBA, the threshold outlined in the Napa County Ordinance. In the short term, project-related construction noise would create noticeably higher ambient noise levels than currently exist at the sensitive receptors. This impact is considered significant. Implementation of Mitigation Measure N-1 (see above) would reduce this impact, but not to a less-than-significant level.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that construction-related noise impacts of the Program Component (i.e., construction of potential future pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs) would be comparable to those described above for the Project Component. Based on preliminary alignment configurations, construction corridors would border sections of residential, commercial, agricultural, and industrial land uses. Sensitive noise receptors such as residences are likely to occur along the route and the noise levels at the receptors would depend on the setback distance of those receptors.

Project impact significance would be based on city and/or county noise thresholds as outlined above. It is possible, if not likely, that construction-related impacts would exceed thresholds of significance at some location where noise sensitive receptors are nearby. This impact is considered significant. Implementation of Mitigation Measure N-1, "Decrease Noise Levels with Use of Noise Reduction Devices," would reduce this impact, but not to a less-than-significant level. This mitigation measure is described under "Water Delivery Project Component (Napa Pipeline)" above.

12.2.7.2 Impact N-4: Exposure of People to Excessive Ground Vibration

Water Delivery Project Component

The breaking of road pavement, movement of heavy equipment, and excavation of trenches could cause the ground to vibrate. Such vibration could be perceptible to people who are at or near the construction activity area, but it would be very localized, temporary (lasting 1 year), and of short, sporadic duration (i.e., periodically during a 3–5 day period). The occupied areas along the Sonoma Pipeline alignment are set back from the construction area a distance of between approximately 300 feet and 0.25 mile. Given that construction-related ground vibration would generally be confined to the immediate vicinity of the activity area and would be temporary, transitory, and short-term, it would not be considered excessive. This impact is considered less than significant. No mitigation is required.

There are 15 homes along Green Island Road that border the CAC Pipeline alignment; there are also scattered homes that border Buchli Station Road, Las Amigas Road, and Stanly Lane along the Napa Pipeline. These homes are set back from the road (i.e., construction area) a distance of approximately 50–200 feet. As stated above, ground vibration would only be felt in the immediate vicinity and would be temporary. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that impacts of ground vibration on receptors along the potential future pipelines would be comparable to those described above for the Project Component. There would be pockets of residential areas and other sensitive receptors along the potential pipeline routes. As characterized above, the construction-related ground vibrations would be very localized, temporary, and short-term. This impact is considered less than significant. No mitigation is required.

12.2.8 Habitat Restoration Option 1: Mix of Ponds and Tidal Marsh

Impacts under Habitat Restoration Option 1 (Impacts N-2 and N-3) are nearly the same as those under Salinity Reduction Option 1A, except that excavation of starter channels and levees, and construction of additional breaches for restoration would be required for this option. Although construction timing and activities would vary slightly, the same equipment would be used.

12.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 (Impacts N-2 and N-3) are nearly the same as those under Habitat Restoration Option 1. These construction activities would be more extensive than under Habitat Restoration Option 1 because of additional construction on Ponds 2E and 6/6A, but operational noise would be somewhat less because less maintenance would be required. ~~t~~The impact conclusions are the same.

12.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts N-2 and N-3) are nearly the same as those under Habitat Restoration Option 1. This option would be the least intensive during construction and most intensive during maintenance, but the impact conclusions are the same.

12.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 (Impacts N-2 and N-3) are nearly the same as those under Habitat Restoration Option 1. There would be some additional noise associated with the construction of this option because of the use of fill material, but the impact conclusions are the same.

Chapter 13

Land Use and Planning

13.1 Environmental Setting

13.1.1 Introduction and Sources of Information

This chapter provides the environmental and regulatory background necessary to analyze land use and agricultural resources effects associated with the proposed project. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project.

Applicable county and regional plans and policies were reviewed for information on existing land uses and policies. The California Department of Conservation, Napa County Planning Department, Solano County Planning Department, and Sonoma County Planning Department were consulted to assess existing conditions of agricultural resources on and surrounding the project area. The Napa and Sonoma County General Plans, City of American Canyon General Plan EIR, and the Novato General Plan provided land use goals and existing land use designations necessary to compare project-related impacts/conflicts with surrounding land uses.

13.1.2 Regulatory Setting

13.1.2.1 Countywide General Plans

Under Sections 65300–65403 of the California Government Code, all cities and counties in California are required to provide comprehensive long-range plans containing seven mandatory elements for lands within their jurisdictions: land use, housing, conservation, open space, noise, and safety. The project area is in Solano ~~and~~, Sonoma and Napa Counties. Portions of Sonoma and Marin Counties, as well as portions of Novato and the City of American Canyon, may also be a part of the project area if recycled water is used in the ~~desalination~~salinity reduction process. The Solano, Napa, Sonoma, and Marin County General Plans, the City of American Canyon General Plan EIR, and the Novato General Plan were reviewed for this chapter.

13.1.2.2 San Francisco Bay Plan/McAteer-Petris Act

The McAteer-Petris Act established the BCDC and mandated the preparation of the Bay Plan. Completed in 1969, the Bay Plan describes the values associated with the bay and presents policies and planning maps to guide future uses of the bay and surrounding shorelines. Under the Bay Plan, suitable uses include port- and water-related industry, airports, wildlife refuges, and water-related recreation. In addition, the Bay Plan supports public access via marinas, waterfront parks, and beaches. The Bay Plan also calls for extensive public access along the bay's waterfront and shorelines. BCDC is responsible for permitting new placement of dredged material or fill in the bay and implementing the policies of the Bay Plan.

13.1.2.3 Regional and Local Planning Documents

~~Petaluma Watershed Enhancement Plan~~

~~This plan identifies four goals designed to enhance the Petaluma River watershed. The goals are to~~

- ~~create a local watershed council that would assist in organizing activities and circulating information,~~
- ~~improve water quality in the Petaluma River watershed such that the Petaluma River could be removed from the San Francisco Bay RWQCB Impaired Waterbody List,~~
- ~~help make agriculture more viable within the community, and~~
- ~~protect and preserve wildlife habitat.~~

San Francisco Estuary Project's Comprehensive Conservation and Management Plan

The San Francisco Estuary Project (SFEP) was established by EPA in 1987 because of growing public concern related to the health of the bay and the Delta. SFEP is jointly sponsored by EPA and the State of California and is part of the National Estuary Program. The primary focus of the CCMP is to "restore and maintain the chemical, physical, and biological integrity of the bay and Delta." The CCMP provides a thorough implementation strategy describing various actions to protect the Bay-Delta estuary. Ten program areas are identified in the CCMP. For each program area, the CCMP presents a problem statement, discusses existing management, identifies program area goals, recommends approaches, and states objectives and actions specific to the program. With regard to wetlands, the CCMP focuses on the restoration and ultimate enhancement of ecological productivity and habitat value.

Baylands Ecosystem Habitat Goals

The Baylands Ecosystem Habitat Goals (Goals Project 1999) Report (*Habitat Goals* report) is a report compiled by the San Francisco Bay Area Wetlands Ecosystem Goals Project to identify wetland restoration goals within the baylands. Recommendations in this report were developed through a consensus process with the input of more than 100 participants representing local, state, and federal agencies, academia, and the private sector. The report recommends the types, areal extent, and distribution of habitats needed to sustain healthy ecosystems in the Bay-Delta estuary and identifies the Napa River Unit as a key area to restore in the north bay.

Ecosystem Restoration Program Plan

The CALFED Bay-Delta Program (CALFED) developed the Ecosystem Restoration Program Plan (ERPP) as one of four Common Programs. The main objective of the ERPP is to address problems related to ecosystem quality of the Bay-Delta system. The CALFED Ecosystem Restoration Program will use the goals outlined by the ERPP in the restoration of physical and biological processes related to formation and maintenance of habitats of the Bay-Delta.

Water Use Efficiency Program Plan

CALFED developed the Water Use Efficiency Program Plan to "help ensure that California's water supplies are used efficiently and result in multiple benefits." CALFED's definition of *efficient water use* is the implementation of local water management actions that increase the achievement of CALFED goals and objectives. One of the primary objectives of the CALFED Program is to improve water supply reliability for California. Water recycling can help meet this objective in its ability to

- provide an additional source of water that is local rather than imported;
- provide increased water for one beneficial use without taking water allocated for other beneficial uses; and
- provide a source of water that is relatively resistant to drought, making it available when it is most needed.

Recycling projects can also aid in achieving CALFED Program objectives of water quality and ecosystem restoration by making available a greater water supply without increasing Delta export or reducing Delta outflow (CALFED Bay-Delta Program 2000).

~~Baylands Ecosystem Habitat Goals~~

~~*Baylands Ecosystem Habitat Goals* (Goals Project 1999) is a report compiled by the San Francisco Bay Area Wetlands Ecosystem Goals Project to identify wetland restoration goals within the baylands. Recommendations in this report were developed through a consensus process with the input of more than 100 participants representing local, state, and federal agencies, academia, and the private sector. The report recommends the types, areal extent, and distribution of habitats needed to sustain healthy ecosystems in the Bay-Delta estuary and identifies the Napa River Unit as a key area to restore in the north bay.~~

Bay Trail Plan

The Bay Trail is a planned recreation corridor that will provide 400 miles of biking and hiking trails when completed. It will link nine counties, 47 cities, and 130 parks and recreation areas around San Francisco and San Pablo Bays. As mandated under Senate Bill 100, ABAG developed the Bay Trail Plan as a framework to provide guidance in the selection and implementation of the Bay Trail project. The main goal of the Bay Trail Plan is to provide public access to the bay and its surrounding shorelines.

Petaluma Watershed Enhancement Plan

This plan identifies four goals designed to enhance the Petaluma River watershed. The goals are to

- create a local watershed council that would assist in organizing activities and circulating information,
- improve water quality in the Petaluma River watershed such that the Petaluma River could be removed from the San Francisco Bay RWQCB Impaired Waterbody List,
- help make agriculture more viable within the community, and
- protect and preserve wildlife habitat.

13.1.3 Regional Setting

The north bay region (made up of parts of Solano, Napa, Sonoma, and Marin Counties, including the cities of American Canyon, Novato, San Rafael, and Vallejo) consists predominantly of two land uses: extensive and intensive agriculture and rural land (60%) and wildlife and open space areas (23%). Remaining land uses in the area—residential, commercial and light industry, public facilities, and heavy industry—each comprise less than 10% of the north bay region. Land use trends include the following (San Francisco Bay Conservation and Development Commission 1997):

- transition of rangeland and pastureland in southern Napa and Sonoma Counties to vineyards,
- development of urban uses along the U.S. 101 and SR 29 corridors, and
- acquisition of large rural areas by federal and state wildlife agencies for wildlife habitat.

East of the project, land use designations are mixed, ranging from general industrial to land intensive agriculture and residential uses. On Edgerley Island immediately east of Pond 8, there is a strip of residential development. South of the project area, Mare Island has been designated by Solano County for industrial use. The land north of the project area has been designated by Napa County as open space. Land west and northwest of the project area across Napa Slough has been designated by Sonoma County as land extensive agriculture, consisting mainly of hay production (Solano County 1999, Napa County 1996, Sonoma County 1998.)

The nearest farmland currently in production is located approximately 500 feet from the project area west of Napa Slough across from Ponds 6 and 6A. Vineyards are approximately 0.25 mile north of Pond 7A.

North of the project area, in Napa County, there are lands designated as *prime farmland*, *land of local importance*, and *farmland of statewide importance*. West of the project area, across Napa Slough, there are farmlands of local importance. Southwest of the project area, in Sonoma County, portions of Tubbs Island are also considered farmland of local importance. The project area does not include any Williamson Act contracts (Domequez pers. comm., Tuter pers. comm.).

13.1.4 Project Area

The project area has an interesting history of land uses. Reclamation of the Napa-Sonoma Marsh began as early as 1850 and peaked between 1880 and 1910. Between 1910 and 1950 the site was used largely for grazing and dryland crops. In 1950, Leslie Salt Company acquired approximately 10,000 acres composed of diked farmland, adjacent marshes, and waters. Leslie Salt Company then converted the land to salt ponds. Salt production began in 1959 and continued until 1990. ~~when t~~The property was sold to the State of California in 1994. Since 1994 the project area has been managed by DFG as part of the NSMWA. The project site is used for recreation. Hunting, fishing, and other recreational opportunities are available on the project site and are described in Chapter 15, "Recreation, Public Access, Visual Resources, and Public Health."

The Bay Plan identifies the project site as wildlife area and managed wetlands. Two proposed alignments of the Bay Trail surround the northern and eastern boundaries of the project area. The eastern alignment is located east of the Napa River. Neither alignment transects the NSMWA.

Portions of the project site located in Solano County are designated as *land extensive agriculture*. These are agricultural lands that tend to have low production per acre and are not irrigated (Solano County 1999). Limited recreational activities, such as hunting, fishing, and boating, take place on these lands. Portions of the project in Napa County are designated as *agriculture, watershed and open space*, which falls under the broader category of open space. The eastern portion of Marin County is primarily designated for open space and recreation as well as extensive agriculture and residential use. Pockets of commercial and light industry and heavy industry border the U.S. 101 corridor. Along Lakeville Road through Sonoma County, land uses are designated primarily for extensive agriculture and, to a lesser extent, intensive agriculture.

According to applicable county general plans and staff at the California Department of Conservation, the project area is classified as farmland (Solano County 1999; Napa County 1996; Sonoma County 1998; Patch pers. comm.).

13.2 Environmental Impacts and Mitigation Measures

13.2.1 Methodology and Significance Criteria

The impacts of the proposed project on land use and agricultural resources were analyzed qualitatively, focusing on consistency between planned and permitted uses under applicable land use plans.

Criteria based on the State CEQA Guidelines were used to determine the significance of land use and planning–related impacts. The project would have a significant impact on land use and planning if it would

- conflict or be incompatible with the land use goals, objectives, or guidance of applicable land use plans or regulations of an agency with jurisdiction over the project;
- substantially alter present or planned land uses of a site in the surrounding area;
- disrupt or divide the physical arrangement of a community; or
- result in a substantial conversion of farmland.

13.2.2 No-Project Alternative

As described in Chapter 2, "Site Description and Options," implementation of the No-Project Alternative would result in degraded habitat conditions for wildlife. Under this alternative salinity levels would continue to increase in the ponds closed to tidal influence. Ponds would be expected to dry out and water control structures would deteriorate. Ultimately, this would reduce DFG's ability to

manage water and salinity levels for wildlife. Therefore, this alternative would be incompatible with the land use identified in the Bay Plan and multiple regional planning documents, including SFEP's CCMP, CALFED's ERPP, and the ~~*Baylands Ecosystem Ecosystem*~~ *Habitat Goals* report. The No-Project Alternative would not alter present or planned land uses of the project site in the surrounding area because land use would not change, and growth would not be induced. Land uses would not change under the No-Project Alternative; consequently, existing communities would not be disrupted or divided. There are no Williamson Act contracts on the project site or any farmland (i.e., prime farmland, unique farmland, or farmland of statewide or local importance) on the project site; therefore, no conflicts with Williamson Act contracts or conversion of farmlands would occur. In addition, the No-Project Alternative would not spur development in the area or lead to the conversion of other farmland to nonagricultural uses.

13.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

13.2.3.1 Impact LU-1: Compatibility with Land Use Goals and Objectives

Implementation of Salinity Reduction Option 1A would be compatible with existing land use goals and objectives outlined in applicable general plans and regional plans because reducing salinity would lead to the restoration of the marsh. Both Napa County's and Solano County's land use designations of the project site allow for use as open space and recreation. The Bay Plan identifies the project site as wildlife area and managed wetlands. Proposed alignments of the Bay Trail that surround the northern and eastern boundaries of the NSMWA would not conflict with this option. This option would be consistent with the ERPP and SFEP's CCMP because it contributes to the process needed for the restoration of marsh habitat in San Francisco Bay. This impact is considered less than significant. No mitigation is required.

13.2.3.2 Impact LU-2: Consistency with Existing or Planned Land Uses

Implementation of this option would not substantially alter existing or planned land uses of the surrounding area. The project site has been managed as a wildlife refuge since 1994; such management would continue. There are a variety of uses surrounding the project site, including agricultural use west of Napa Slough. Surrounding land uses would be unaffected because salinity reduction would not encourage growth or development of surrounding land uses. Recreational use is expected to increase as a result of the restoration project, but the intensity of use would be minimal and localized to the project site. This option would not disrupt or divide the physical arrangement of a community

because land use on the project site would not change. The project site would still be managed as a wildlife area. This impact is considered less than significant. No mitigation is required.

13.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts LU-1 and LU-2) are nearly the same as those under Salinity Reduction Option 1A. Salinity Reduction Option 1B would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses.

13.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C (Impacts LU-1 and LU-2) are nearly the same as those under Salinity Reduction Option 1A. Salinity Reduction Option 1C would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses.

13.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 (Impacts LU-1 and LU-2) are nearly the same as those under Salinity Reduction Option 1A. Salinity Reduction Option 2 would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses.

13.2.7 Water Delivery Option

13.2.7.1 Impact LU-1: Consistency with Land Use Goals and Objectives

Subsurface utilities such as the proposed Sonoma, CAC, and Napa Pipelines do not, in and of themselves, typically conflict with or generally relate to land use goals, objectives, and guidance. Construction activities associated with the pipelines can, however, pose the potential to conflict with existing uses.

Land Use Compatibility during Construction

Water Delivery Project Component (Sonoma Pipeline)

Placement of the new Sonoma Pipeline through the wildlife preserve would be within the northern portion of the ROW. There are scattered homes bordering the construction corridor along the first 3 miles of new pipeline. The remaining portion of the new Sonoma Pipeline would extend along the existing access road to the Napa River Unit.

Construction of the pipeline would proceed in increments approximately 200–300 feet long within a construction corridor width of approximately 30 feet. Noise from equipment operation could adversely affect nearby land uses, including homes as close as 300 feet from the construction area. As described in Chapter 12, "Noise," construction noise impacts on sensitive receptors such as homes would be a less-than-significant impact of the Sonoma Pipeline. Given the undeveloped rural nature of the surrounding area and the relatively short-term and isolated nature of construction activities occurring at any given time, no significant land use conflicts are anticipated for construction of the Sonoma Pipeline. This impact is considered less than significant. No mitigation is required.

~~Water Delivery Project Component (CAC Pipeline)~~

~~Construction of the new CAC Pipeline is proposed along Green Island Road and Mezzetta Road. The southern segment of this route is bordered by a mix of vacant land and residential and industrial land uses; the northern segment is bordered by residential and commercial land uses. During construction occurring immediately adjacent to existing residences and businesses, access to and from these uses may be periodically affected; however, access limitations, if any, would be very short-term and the construction contractor would coordinate in advance with the affected homes and businesses to reduce potential inconveniences.~~

~~Installation of the pipeline along Green Island Road and Mezzetta Road would include operation of heavy-duty construction equipment such as a crane, excavator, front-end loader, and pipe truck. The noise from equipment operation could adversely affect nearby land uses, including homes located as close as 50 feet from the road. As described in Chapter 12, "Noise," construction noise impacts related to construction of the CAC Pipeline on sensitive receptors such as homes would constitute a short-term significant impact. Implementation of Mitigation Measure N-1, "Decrease Noise Levels with Use of Noise Reduction Devices," would reduce this impact, but not to a less-than-significant level. This measure is described in Chapter 12.~~

Water Delivery Project Component (Napa Pipeline)

Construction of the Napa Pipeline is proposed along Buchli Station Road, Las Amigas Road, across the Stanly Ranch property, along Stanly Lane, and under the Napa River. Segment 1, which has been evaluated previously, was found to be consistent with land uses, goals, and objectives. Pipeline placed in Segment 2 would be bordered by primarily residential land uses (a winery also exists along Segment 2). As stated above for the CAC Pipeline, access to these properties

may be limited periodically; however, the limitations, if any, would be very short-term and would be coordinated in advance with the affected home or business owner.

Installation of the pipeline would include operation of heavy-duty construction equipment. The noise from equipment operation is considered a short-term significant impact, as described in Chapter 12, "Noise." Implementation of Mitigation Measure N-1, "Decrease Noise Levels with Use of Noise Reduction Devices," would reduce this impact, but not to a less-than-significant level. This measure is described in Chapter 12.

Water Delivery Project Component (CAC Pipeline)

Construction of the new CAC Pipeline is proposed along Green Island Road and Mezzetta Road. The southern segment of this route is bordered by a mix of vacant land and residential and industrial land uses; the northern segment is bordered by residential and commercial land uses. During construction occurring immediately adjacent to existing residences and businesses, access to and from these uses may be periodically affected; however, access limitations, if any, would be very short-term and the construction contractor would coordinate in advance with the affected homes and businesses to reduce potential inconveniences.

Installation of the pipeline along Green Island Road and Mezzetta Road would include operation of heavy-duty construction equipment such as a crane, excavator, front-end loader, and pipe truck. The noise from equipment operation could adversely affect nearby land uses, including homes located as close as 50 feet from the road. As described in Chapter 12, "Noise," construction noise impacts related to construction of the CAC Pipeline on sensitive receptors such as homes would constitute a short-term significant impact. Implementation of Mitigation Measure N-1, "Decrease Noise Levels with Use of Noise Reduction Devices," would reduce this impact, but not to a less-than-significant level. This measure is described in Chapter 12.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. Land use considerations for each pipeline are described below based on the general locations of potential alignments.

The pipelines for the City of Petaluma, Novato SD, and LGVSD would border commercial, residential, agricultural, and industrial areas. There is a potential for construction-related land-use conflicts along these potential pipeline routes, such as from construction activity near residential development and schools, and from traffic detours near commercial areas.

As discussed above for the Project Component impacts, the construction would be short term, but the associated noise impacts on sensitive uses are still considered significant.

Consistency with Land Use Policies and Goals

Water Delivery Project Component

The use of recycled water for pond desalination is consistent with the water use policies and goals of several plans such as the CALFED Water Use Efficiency Program Plan described above and the water recycling legislation described in Chapter 4, "Water Quality." The future use of recycled water for agricultural irrigation following completion of the desalination process is another way in which the Water Delivery Option responds to those plans.

In summary, installation of the pipelines proposed for the Water Delivery Option would be consistent with various plans and policies related to efficient water use and management and, with the exception of construction noise along the Napa and CAC Pipelines (see Chapter 12, "Noise"), would not conflict with existing land uses or related plans and policies. Therefore, this impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Similar to the above, the potential future pipelines' provision of recycled water for pond desalination and agricultural irrigation would be compatible with, if not complementary to, various plan goals, objectives, and policies regarding efficient water management.

Within the Petaluma Watershed Enhancement Plan, Goal C is to "support the viability of agriculture in the community." A related objective is to "provide technical information to interested agricultural operators about the potential benefits and detriments of using reclaimed wastewater."

The "Public Facilities and Services" section of the Novato General Plan includes the objective to "manage the water supply through coordination with providers and water conservation," and proposes several programs to achieve the objective.

The provision of recycled water from treatment plants in the north bay region, including the Novato SD WWTP, for use in pond desalination and as agricultural irrigation water is consistent with this objective.

In summary, implementation of the potential future pipelines proposed as the Program Component of the Water Delivery Option would be consistent with various plans and policies related to efficient water use and management and, with the exception of construction noise in proximity to sensitive receptors (see Chapter 12, "Noise"), would not conflict with existing land uses or related plans and policies. Therefore, this impact is considered less than significant. No mitigation is required.

13.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Habitat Restoration Option 1 would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses. Adjacent land uses could be adversely affected as a result of levee failures. This impact is described in Chapter 3, "Hydrology."

13.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Habitat Restoration Option 2 would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses. Adjacent land uses could be adversely affected as a result of levee failures. This impact is described in Chapter 3, "Hydrology."

13.2.10 Habitat Restoration Option 3: Pond Emphasis

Habitat Restoration Option 3 would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses. Adjacent land uses could be adversely affected as a result of levee failures. This impact is described in Chapter 3, "Hydrology."

13.2.11 Habitat Restoration Option 4: Accelerated Restoration

Habitat Restoration Option 4 would be compatible with regional and local land use plans and would not conflict with or adversely affect surrounding land uses. Adjacent land uses could be adversely affected as a result of levee failures. This impact is described in Chapter 3, "Hydrology."

Chapter 14
Public Services and Utilities

14.1 Environmental Setting

14.1.1 Introduction and Sources of Information

This chapter provides the environmental and regulatory background necessary to analyze public services and utilities effects associated with the proposed project. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project.

Public service standards for fire protection, police protection, schools, and parks typically apply to urbanization projects. Because the project would not increase the human population in the area, except for possible recreational usage, the service ratios and response times or performance objectives of the local fire protection and police protection services would not be affected. Even an increase in recreational usage (addressed in Chapter 15, "Recreation, Public Access, Visual Resources, and Public Health") is not anticipated to affect police protection services. Demand for schools or parks would not change. Therefore, public services are not discussed further in this document.

Information on existing utilities was obtained through discussions with DFG and PG&E.

14.1.2 Regulatory Setting

The California Public Utilities Commission regulates the use and location of public utilities, including high-voltage towers.

The project would continue to honor existing easements and ROWs as stipulated in the property deeds.

14.1.3 Project Setting

14.1.3.1 Utilities

Utilities on the project site ~~include~~ consist primarily of electrical power. There is limited electrical power on-site because of the rural nature of the site. The most notable utility on-site is two high-voltage power lines, 230 kilovolts (kv) and 115 kv, that cross the project area, beginning at the southernmost tip of Pond 6 and extending east over Ponds 1A and 1, and through Ponds 2A and 4, parallel to SR 37. There are approximately 14 towers in the project area (Figure 2-2). On the project site the towers provide electricity to the pump station and to the Can Duck Club caretaker's house located on Pond 1.

Separately, an electrical and emergency telephone box ~~would be~~ was installed from Milton Road to the newly constructed fish screen on Pond 8 (Wyckoff pers. comm.).

In addition, there are two 12-kv pole lines in the project area. One extends from SR 37 and the southern parking lot up along the east side of Pond 1. The second is east of Pond 8, along the eastern edge of Edgerley Island.

Routine maintenance of the towers and poles includes a yearly visual inspection of each tower and monthly reading of a meter associated with the 12-kv pole (San Julian pers. comm.). There is a pump station in the northern portion of Pond 1 that is fed electricity from the utility towers. The pumps are maintained and used by DFG.

There is no natural gas, potable water, or telephone service on site, and sewer utilities are connected to a septic system at the Can Duck Club (Allen pers. comm., Giovannoni pers. comm.).

14.2 Environmental Impacts and Mitigation Measures

14.2.1 Methodology and Significance Criteria

Impacts on public utilities were analyzed qualitatively, focusing on existing utilities. Criteria based on the State CEQA Guidelines were used to determine the significance of utilities-related impacts. As mentioned above under "Introduction and Sources of Information," the project would not affect public services; therefore, impacts on public services were not analyzed. The project would have a significant impact on utilities if it would conflict with existing utility infrastructure or service.

14.2.2 No-Project Alternative

14.2.2.1 Impact PS-1: Conflict with Existing Utilities

The No-Project Alternative would lead to unintentional levee breaching as described in Chapter 2, "Site Description and Options." Anticipated breaches would not affect existing utilities, based on the location of the utilities and expected breaching. Access would not be affected by this alternative. Therefore, the No-Project Alternative would not conflict with existing utility infrastructure. This impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

14.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

14.2.3.1 Impact PS-1: Conflict with Existing Utilities

Implementation of Salinity Reduction Option 1A would not affect existing utilities located within ponds. Implementation of this option requires levee maintenance, which would protect utilities found outside the ponds from flooding. Access to all utility infrastructure is required for maintenance of such infrastructure. Access would not be affected by this option. The Pond 4 outfall would not affect the nearest power tower footing, which is located approximately 1,000 feet away. This impact is considered less than significant. No mitigation is required.

14.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Salinity Reduction Option 1B requires the breaching of levees. Ponds 1, 1A, and 2 would remain under the existing management. Utilities located in and around these ponds would be unaffected by the implementation of this option. Furthermore, PG&E access in and around these ponds would not be affected. All other utilities near project site ponds, except for utilities near Pond 4, would be protected by levees and levee maintenance as would be required under this option. These utilities would not be affected by this option.

PG&E must be allowed access to all lands described in its easement. The ability to access the towers at all times is critical to tower maintenance. If access is reduced as a result of this option, the project applicant would be required to provide PG&E access as described in the easement agreements. Construction of boardwalks along the levees or ensuring boat access to utility infrastructure are examples of potential mechanisms to maintain access to PG&E infrastructure.

14.2.4.1 Impact PS-2: Increased Risk of Instability of Power Towers

Two power towers are located outside the levee of Pond 4, one on the Napa River and one on China Slough. A Pond 3 levee breach would occur approximately 2 miles from the Napa River tower footing and farther from the China Slough tower footing. The breach is unlikely to cause outboard marsh erosion around the tower footings during the salinity reduction process. Access to both these towers is expected to be available by boat via the Napa River and China Slough, respectively.

This impact is considered less than significant. No mitigation is required.

14.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Salinity Reduction Option 1C is similar to Salinity Reduction Option 1B, except that the Pond 4 levee would be breached.

14.2.5.1 Impact PS-2: Increased Risk of Instability of Power Towers

Two power towers are located outside the levee of Pond 4, one on the Napa River and one on China Slough. In addition to a Pond 3 levee breach, the levee on Pond 4 would be breached approximately 1,500 to 2,000 feet from the Napa River tower footing. This breach could affect the outboard marsh in the vicinity of the power tower. The China Slough tower footing is unlikely to be affected during the salinity reduction process. Access to both these towers is expected to be available by boat via the Napa River and China Slough, respectively. This impact is considered significant. Implementation of Mitigation Measure PS-1 would reduce this impact to a less-than-significant level.

Mitigation Measure PS-1: Ensure the Stability of the Power Towers

The project sponsors will conduct site-specific surveys of the power towers to ensure that the towers are not adversely affected. Surveys will include an assessment of the potential marsh erosion around the tower footings. If necessary, site-specific measures will be implemented to ensure stability of the utility towers. These measures may include encasing the towers with concrete to above the high-water mark and relocating levee breaches to reduce impacts.

14.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

14.2.6.1 Impact PS-1: Conflict with Existing Utilities

Implementation of Salinity Reduction Option 2 would not affect existing utilities. This option includes reducing the salinity of upper ponds and mixing in and discharging, via Ponds 1, 1A, and 2. Water levels of Ponds 1A and 1 may increase slightly during the salinity reduction process. Increased water levels of these ponds would not affect utility infrastructure because increases in water levels are expected to be minimal and temporary. Implementation of this option requires levee maintenance, which would protect utilities found outside the ponds from flooding. Access to all utility infrastructure is required for maintenance of such infrastructure. Access would not be affected by this option. This impact is considered less than significant. No mitigation is required.

14.2.7 Water Delivery Option

Other than the routine subsurface utility checks that occur in the route selection and refinement of any pipeline project, the Water Delivery Option does not have much, if any, relationship to existing utility infrastructure or service. As such, no impacts would result from implementation of this option.

14.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Habitat Restoration Option 1 involves the restoration of existing ponds into a mixture of managed ponds and tidal marsh. As part of the tidal restoration, levees of Ponds 3, 4, and 5 would be breached. Potentially Ponds 6 and 6A would also be restored to tidal marsh. There are no utilities in or around Ponds 3, 5, 6, and 6A. Utilities found around Pond 4 may be affected by Habitat Restoration Option 1 depending on where levee breaching occurs. Currently several breaches are planned for China Slough, which could affect the outboard marsh at the base of the China Sough power tower. Levee maintenance and repair would protect the remaining utilities on the project site.

The impact under Habitat Restoration Option 1 (Impact PS-2) is similar to that under Salinity Reduction Option 1C, although the breaches are substantially larger and additional tidal action and erosion could occur. This impact is considered significant. Implementation of Mitigation Measure PS-1, "Ensure the Stability of the Power Towers," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1C.

14.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Habitat Restoration Option 2 emphasizes tidal marsh restoration. More ponds would be restored to tidal marsh under this option than under Habitat Restoration Option 1. Specifically, Ponds 3, 4, 5, the eastern half of 2, 6, and 6A would be restored to tidal marsh. There are no utilities around Ponds 2, 3, 5, 6, and 6A. Utilities around Pond 4 might be affected as described under Habitat Restoration Option 1. Remaining utilities would be protected by levee maintenance.

The impact under Habitat Restoration Option 2 (Impact PS-2) is nearly the same as that under Habitat Restoration Option 1 and would be mitigated by implementation of Mitigation Measure PS-1.

14.2.10 Habitat Restoration Option 3: Pond Emphasis

Habitat Restoration Option 3 emphasizes pond management. Compared to Habitat Restoration Option 1, Habitat Restoration Option 3 would lead to a greater number of managed ponds and less tidal marsh restoration. Utilities around Pond 4 might be affected as described under Habitat Restoration Option 1. Remaining utilities would be protected by levee maintenance.

The impact under Habitat Restoration Option 3 (Impact PS-2) is nearly the same as that under Habitat Restoration Option 1 and would be mitigated by implementation of Mitigation Measure PS-1.

14.2.11 Habitat Restoration Option 4: Accelerated Restoration

Habitat Restoration Option 4 is nearly the same as Habitat Restoration Option 1, except that Habitat Restoration Option 4 includes design features that would accelerate the restoration process. The accelerated design features of Habitat Restoration Option 4 would not affect existing utilities. Therefore, the impact under Habitat Restoration Option 4 (Impact PS-2) is nearly the same as that under Habitat Restoration Option 1 and would be mitigated by implementation of Mitigation Measure PS-1.

Chapter 15

Recreation, Public Access, Visual Resources, and Public Health

15.1 Environmental Setting

15.1.1 Introduction and Sources of Information

This chapter provides the environmental and regulatory background necessary to analyze recreation, public access, and visual resources effects of the project. It also evaluates public health and safety issues for this project, focusing on public nuisances associated with mosquitoes and diseases transmitted to humans by mosquitoes. This chapter includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Sources of information used in this chapter include applicable Napa, Solano, and Sonoma County General Plans, the Novato General Plan, the *City of American Canyon General Plan EIR*, the Bay Plan, the Bay Trail Plan (Association of Bay Area Governments 2001), *Stanly Ranch Specific Plan Draft EIR* (Brady/LSA, August 1998), *Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration* (Napa Sanitation District, January 11, 1995), and literature on mosquito ecology and control methods.

15.1.2 Regulatory Setting

15.1.1.1 Recreation Policies of the Napa, Solano, and Sonoma County General Plans and Novato General Plan

The Napa, Solano, and Sonoma County General Plans ~~and the Novato General Plan~~ all have policies that pertain to the establishment, enhancement, and maintenance of recreational opportunities on county lands. Included below are excerpts of these policies.

The Napa County General Plan policies that relate to the project area include:

> Return salt extraction ponds to marshlands or other non-urban uses for recreation, fisheries and wildlife habitat at the termination of salt extraction activity.
>
> Encourage wildlife habitat improvements for hunting or nonconsumptive wildlife uses such as photography and maintaining food chains and checks and balances of natural habitat.
>
> Provide recreational and open space opportunities… by maximizing scenic and wildlife habitats by retaining natural vegetation, installing supplementary landscaping, acquiring additional land for open space purposes and by shaping the structures to have a more attractive form and greater usefulness for open space activities.
>
> Promote development of local State Parks for recreation.

In Solano County, general plan goals associated with recreation include:

> Preserve and protect the diverse park, open space and recreational resources of the County for the use and enhancement of the lives of present and future generations.
>
> Develop and maintain recreational facilities to meet the varied recreational needs of the county.

The Solano County General Plan also includes a recreation policy specifically related to the Napa River Unit that states: "Within the Napa Marsh provisions should be made for public recreation and access to the marsh for such uses as fishing, hunting, picnicking, hiking and nature and wildlife study."

The Open Space Element of the Sonoma County General Plan was written in order to protect open space as a limited and valuable resource. The following goal addresses the establishment of those resources:

> Goal OS-7: Establish a countywide park and trail system which meets future recreational needs of the county's residents while protecting agricultural uses. The emphasis of the trail system should be near urban areas and on public lands.

The Environment Chapter of the Novato General Plan states as one of its objectives, "Provide an attractive and comprehensive system of parks and trails throughout the city to meet the recreational needs of the entire community." Additionally, the general plan proposes to develop a financial plan for the improvement and maintenance of an urban trails system.

~~The McAteer-Petris Act of 1965 established BCDC as the state agency responsible for increasing public access to the shores and waterfront of the bay as described in Chapter 13, "Land Use and Planning." The act also mandated the creation of the Bay Plan. The Bay Plan encourages public access through marinas, waterfront parks, and beaches, except where public safety is jeopardized or public access conflicts with significant uses.~~

15.1.2.1 The Bay Trail Plan

The Bay Trail Plan was adopted by ABAG in 1989, in support of the Bay Plan's goal of increasing public access to the bay and its shorelines. Once completed, the Bay Trail will be a 400-mile continuous recreation corridor around the bay, linking nine counties and 47 cities (see Chapter 13, "Land Use and Planning").

15.1.2.2 Visual Resources Elements

The Environment Chapter of the Novato General Plan states as one of its objectives, "Preserve visual values on hillsides, ridgelines, and other scenic resources." Additionally, the general plan aims to encourage protection of visual access to the San Pablo Bay shoreline and the Petaluma River.

The Open Space Element of the Sonoma County General Plan has established many goals and objectives in order to preserve their natural and scenic resources. These goals and objectives include:

> Goal OS-1: Preserve the visual identities of communities by maintaining open space areas between cities and communities.
>
> Goal OS-3: Identify and preserve roadside landscapes which have a high visual quality as they contribute to the living environment of local residents and to the county's tourism economy.
>
> Objective OS-3.2: Provide guidelines so future land uses, development and roadway construction are compatible with the preservation of scenic values along designated scenic highway corridors.

The Open Space Element of the Napa County General Plan states as one of its goals that "Land use patterns should include visual consideration. The landscape can easily become a hodge-podge of roof tops, shining mobile homes, power lines and poles. Therefore, the appropriate density and cluster subdivision design form should be carefully planned."

The Solano General Plan Highway 37 from Solano-Sonoma County line to I-80 at Vallejo as a scenic thoroughfare.

15.1.2.3 Mosquito Abatement Districts

The project area is in the jurisdiction of the Napa County Mosquito Abatement District (NCMAD), Marin-Sonoma Mosquito Vector Control District (MSMVCD), and the Solano County Mosquito Abatement District (SCMAD). Mosquito abatement districts (MADs) and vector control districts (VADs) are governmental organizations formed at the local level that are responsible for controlling specific disease vectors within their jurisdiction. MADs/VCDs

receive most of their revenue from property taxes and are primarily responsible for controlling mosquitoes as pest species and as disease vectors. In the project area, mosquito abatement efforts are primarily focused on controlling mosquitoes that can transmit malaria and several types of encephalitis or cause a substantial nuisance in surrounding communities. California law requires that if a problem source of mosquito production exists as a result of human-made conditions, the party responsible for those conditions is liable for the cost of abatement. The law is enforced at the discretion of the responsible MAD/VCD (Cal. Health and Safety Code Section 2200 *et seq.*).

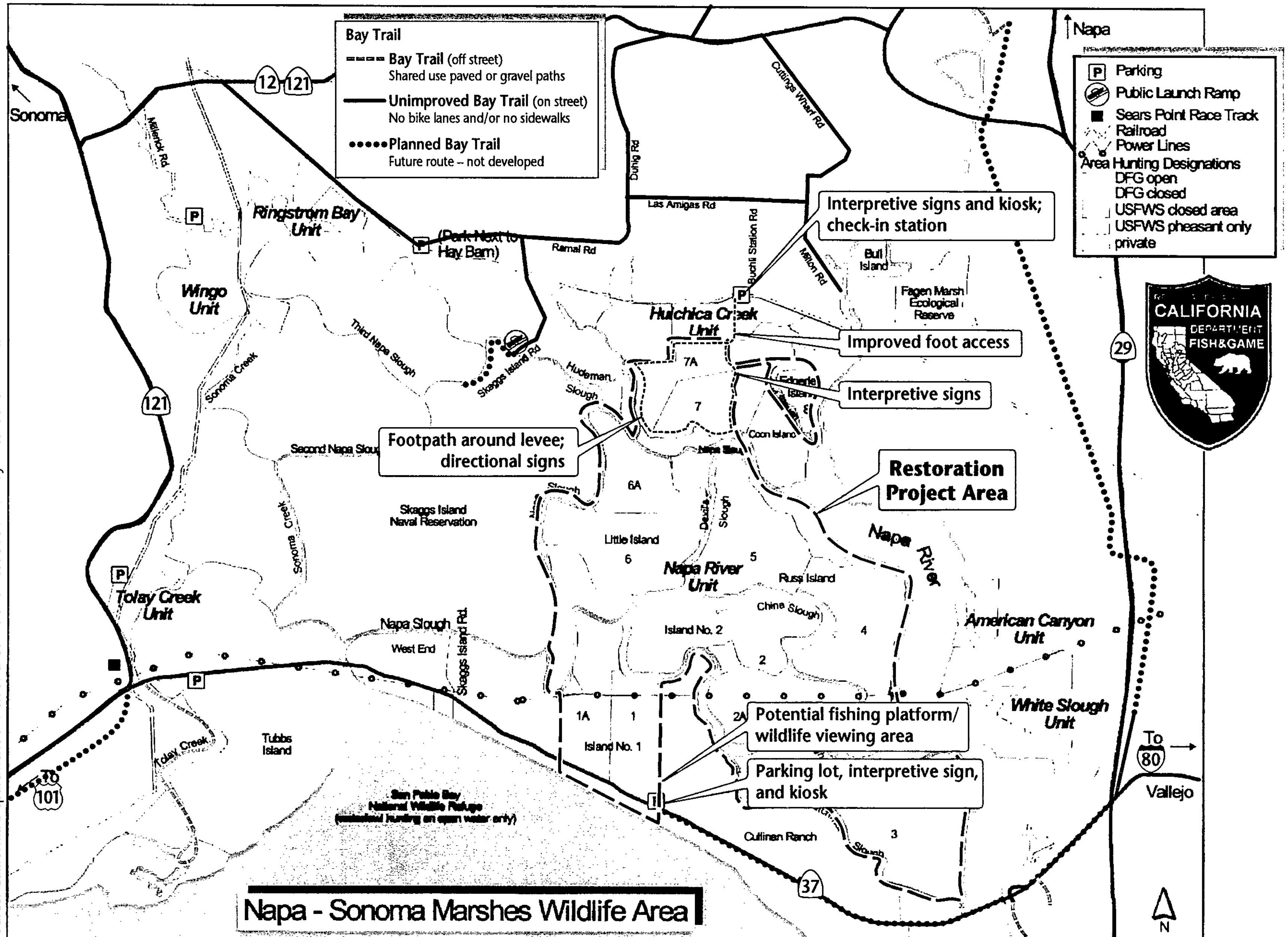
The decision to control mosquitoes as a nuisance to human populations is at the discretion of each local MAD/VCD. Factors influencing this decision may include the number of service calls received from a given locality, the proximity of mosquito sources to population centers, the availability of funds for abatement, the density of mosquito larvae present in a mosquito production source, and the number of adult mosquitoes captured per night in light traps (Jones & Stokes Associates 1995). Once a recurring mosquito production source has been identified, abatement schedules are often adopted and maintained for that source (Jones & Stokes Associates 1995).

15.1.3 Regional Setting

About 23% of the land in the north bay region (made up of parts of Solano, Napa, Sonoma, and Marin Counties, including the cities of American Canyon, Novato, San Rafael, and Vallejo) is used for open space and recreation (San Francisco Bay Conservation and Development Commission 1997). Larger pockets of this land use type can be found in Napa and Solano Counties south and east of Skaggs Island Road; in Napa County south of Napa Slough; in Marin County north of SR 37 and north of Atherton Avenue; and in Marin County east of U.S. 101 and south of Ignacio Boulevard.

15.1.3.1 Recreation and Public Access

The project site is part of the 7-unit NSMWA complex. The NSMWA is an area of baylands, tidal sloughs, and wetland habitat located primarily between the Napa River and Sonoma Creek. More than 13,000 acres are currently managed by DFG. Approximately 10,000 acres of this property is composed of the former evaporative salt ponds, levees, and accreted tidal lands that DFG purchased from Cargill Salt in 1994. DFG manages the site for wildlife and wildlife-compatible uses including recreation. The region surrounding the project area is accessed by multiple users, including bicyclists, hikers using the Bay Trail, fishermen, and duck hunters (Figure 15-1).



Source: California Department of Fish and Game and Association of Bay Area Governments

01396.01 EIR

Jones & Stokes

Figure 15-1
Recreation and Proposed Recreation Features

15.1.3.2 Visual Resources

The Napa River Salt Marsh Restoration Project is set within the north San Pablo Bay region. The region is surrounded on the west, north, and east by the California Coastal Ranges and on the south by San Pablo Bay. Visual resources adjacent to San Pablo Bay vary from rural to urban. Grazed and farmed baylands, vineyards, marsh and other open space, and rural residences and farm support structures crisscross rural areas. Urban area visual resources include industrial and residential developments and associated infrastructure. Also, numerous creeks, sloughs, and rivers drain into San Pablo Bay, adding a distinctive element to the region's visual character.

15.1.3.3 Public Health

Compared with the historical levels of mosquito-borne diseases in humans, levels of mosquito-borne diseases in California are low. These diseases, including encephalitis and malaria, however, are still present or could be readily reintroduced. (Bohart and Washino 1978, Sacramento-Yolo County Mosquito Abatement and Vector Control District 1990.)

All species of mosquitoes require standing water to complete their growth cycle; therefore, any body of standing water represents a potential mosquito breeding site. Areas that pond surface water and are flushed by daily tides are not stagnant for periods sufficient for mosquito larvae to mature; therefore, such areas are not mosquito production sources, and are not of concern to MADs/VCDs (Maffei pers. comm.).

Water quality affects the productivity of a potential mosquito-breeding site. Typically, greater numbers of mosquitoes are produced in water bodies with poor circulation, higher temperatures, and higher organic content (and therefore with poor water quality) than in water bodies having good circulation, lower temperatures, and lower organic content (Collins and Resh 1989). Irrigation and flooding practices may also influence the level of mosquito production associated with a water body. Typically, greater numbers of mosquitoes are produced in water bodies with water levels that slowly increase or recede than in water bodies with water levels that are stable or that rapidly fluctuate (Jones & Stokes Associates 1995). Additionally, the types of vegetation growing in standing ponds can have major effects on mosquito production. For instance, mosquitoes will not reproduce in areas with an abundance of California cord grass, but they will reproduce in areas growing saltgrass and pickleweed (Maffei pers. comm.).

Mosquitoes are adapted to breed during periods of temporary flooding and can complete their life cycles before water evaporates and predator populations become well established. Poor drainage conditions that result in ponding water and water management practices associated with the creation of seasonal wetlands for waterfowl use result in the types of flooding that can produce problem numbers of mosquitoes (Jones & Stokes Associates 1995).

Permanent bodies of open water that have good water quality (good circulation, low temperatures, and low organic content) typically sustain stable nutrient content and support rich floral and faunal species diversity, including mosquito predators and pathogens. Wave action across larger bodies of water physically retards mosquito production by inhibiting egg-laying and larval survival (Jones & Stokes Associates 1995).

15.1.4 Project Setting

15.1.4.1 Recreation and Public Access

Napa River Unit

DFG has managed the salt ponds since 1994. The project area for the salinity reduction and habitat restoration options is composed of the Napa River Unit, and access to the northern project area requires travel through a portion of the Huichica Creek Unit of the NSMWA. Both these areas are largely open to the public, although there is limited access because of a lack of trails on-site. DFG provides two public parking lots, one on SR 37, ~~and~~ one north of the salt ponds at the end of Buchli Station Road, and one at the end of Milton Road. Access to the salt ponds is best accomplished by boat. Nearby boat launch facilities are provided on Cuttings Wharf Road and Skaggs Island Road (Figure 2-1).

Bird watching and hiking are allowed throughout the site except on the levees adjacent to Pond 2, and hunting and fishing are allowed everywhere except the northern portions of Ponds 1 and 1A, Pond 2, and Pond 8. DFG estimates from visitor log books that approximately 1,000 people use the site annually, including 600 hunters and 400 visitors engaged in other natural activities (Wyckoff pers. comm.).

There are two duck clubs in the area of the salt ponds. The Can Duck Club leases Pond 2 for hunting and fishing; there are 50 households that are members of the club. Hunting occurs mainly on the northern portion of Pond 2. There are approximately 16 duck blinds scattered on Pond 2. Approximately eight blinds are permanent and made of concrete. The rest of the blinds are wooden and need to be replaced every 5 years (Allen pers. comm.). The blinds are located a couple of hundred yards from the edge of the pond. The Can Duck Club has a clubhouse in the northwestern corner of Pond 2 and a caretaker's house in the northwestern portion of Pond 1. Their lease has been~~is being~~ renegotiated with DFG and will expire in 2007~~6~~ (Wyckoff pers. comm., Allen pers. comm.). There is also a privately held duck club on the northeastern portion of the island on which Pond 6A is located. This parcel is privately owned. The property contains a simple structure for club member recreational use. Hunting and fishing occur throughout this property.

Separately from this project, DFG has prepared a draft recreation and public use plan for the NSMWA. This document will be incorporated into the NSMWA Management Plan. The recreation plan is expected to focus on improvement of public access and educational opportunities. The plan may include improving internal roads, constructing fishing platforms on restored ponds, improving footpaths, and repairing parking lots, interpretive signs, and display boards.

The Bay Plan identifies the Napa River Unit as wildlife area and managed wetlands. Two proposed alignments of the Bay Trail surround the northern and eastern boundaries of the project area. The eastern alignment is east of the Napa River. One of the proposed Bay Trail alignments terminates at the Hudeman Slough boat launch off Skaggs Road in Sonoma County. Neither alignment transects the NSMWA.

Water Delivery Project and Program Component Areas

There are numerous parks and recreational facilities throughout Napa, Sonoma, and Marin Counties. Following are many of the parks in the Project and Program Component areas:

- Hollenberger Park, Rocky Memorial Dog Park, and Petaluma Marina, all south of Lakeville Road;
- Del Oro Park, Adobe Creek Golf and Country Club, and Miwok Park, all north of Lakeville Road;
- Huichica Creek Unit, Ringstrom Bay Unit, and Hudeman Slough, all south of Ramal Road;
- Wingo Unit, southwest of the Ringstrom Bay Unit with access from the Millerick Road exit off of SR 121;
- Deer Island Open Space Preserve, about 0.5 mile north of SR 37;
- Tolay Creek, just east of the intersection of SR 121 and SR 37;
- the Bay Trail, along SR 37; and
- Long Verde Open Space Preserve, west of U.S. 101.

15.1.4.2 Visual Resources

Napa River Unit

Visual resources in the project area are primarily rural with marsh, salt pond, and other undeveloped open space. The salinity reduction and habitat restoration alternatives would occur within salt ponds and be surrounded by the Skaggs Island Naval Reserve, the NSMWA, and associated creeks, sloughs, and the Napa River. The city of Vallejo lies to the southeast of the salt ponds.

Water Delivery Project and Program Component Areas

The areas of the Project and Program Components of the Water Delivery Option span primarily either pastureland or parallel rail lines. The Sonoma Pipeline would initially cross Schell Slough as it passes through grazed bayland. Once the Sonoma Pipeline begins paralleling the NWPRA railroad, nearby landscapes include vineyard, marsh, and other open space. These landscapes would continue until the pipeline reaches the salt ponds. Other visual resources along this pipeline alignment include rural residences, farm support structures, and numerous creeks.

Segment 1 of the Napa Pipeline has been evaluated previously, and the effects on aesthetics were found to be less than significant. Segment 1, therefore, is not reevaluated under this resource category. Segment 2 of the Napa Pipeline would be constructed down Buchli Station Road. Surrounding landscapes include vineyard and open space as well as a scattering of homes. These landscapes continue until the pipeline reaches the salt ponds.

The CAC Pipeline would begin on Mezzetta Court, surrounded by warehouses in an industrial setting. As the pipeline alignment intersects Green Island Road, visual resources include scattered residences and vineyards. After the pipeline crosses the Napa River it would enter the salt ponds slated for restoration.

15.1.4.3 Public Health

Napa River Unit

From 1925, when NCMAD was established, until Cargill diked off the Napa River Unit for salt production, the project area was a problematic source of large mosquito populations. Each year, NCMAD used convict labor to place 50 to 100 ~~one hundred~~ 55-gallon drums of larvicidal oil around the marsh for treatment of shallow areas (Maffei pers. comm.).

Today, the ponds in the Napa River Unit are regularly patrolled by NCMAD, but there are few mosquito problems because of the high salinity levels of the ponds. When outbreaks do occur, they are usually in the northern reaches of the project area, on and around Edgerley Island. NCMAD treats problem areas with bacteria administered either by boat or by helicopter (Maffei pers. comm.).

Water Delivery Project and Program Component Areas

Mosquito abatement also occurs along the Water Delivery Option's Project and Program Component areas where suitable habitat exists in seasonal wetlands.

15.2 Environmental Impacts and Mitigation Measures

15.2.1 Methodology and Significance Criteria

15.2.1.1 Recreation and Public Access

The impacts of the project on recreation and public access were analyzed qualitatively, focusing on existing and proposed recreation and public access policies related to the project area, the types of changes expected to result, and the potential of the restoration changes to adversely affect current and proposed public access and recreational uses at the NSMWA.

Criteria based on the State CEQA Guidelines and professional judgment were used to determine the significance of recreation and public access impacts. The project would have a significant impact on recreation and public access if it would

- increase use of recreational facilities such that substantial physical deterioration of a recreational facility would occur or be accelerated;
- include recreational facilities or require the expansion of recreational facilities that might have an adverse physical effect on the environment;
- conflict with existing or planned recreational use and recreation policies; or
- conflict with existing or planned public access plans.

15.2.1.2 Visual Resources

The impacts of the project on visual resources were analyzed qualitatively. Criteria based on the State CEQA Guidelines and professional judgment were used to determine the significance of visual resources impacts. The proposed project would have a significant impact on visual resources if it would have a substantial adverse effect on a scenic vista.

15.2.1.3 Public Health

The impacts of the project on public health were analyzed qualitatively. Criteria based on professional judgment were used to determine the significance of public health impacts. In this analysis, an alternative would be considered to have a significant impact if habitat changes would necessitate increasing levels of mosquito abatement programs to maintain mosquito populations at preproject levels. Habitat changes that could result in a substantial decline of available

mosquito breeding habitat or greater efficiency of NCMAD's abatement program would be considered beneficial impacts.

15.2.2 No-Project Alternative

Implementation of the No-Project Alternative would result in degraded habitat conditions for wildlife as well as mosquitoes. Under this alternative, salinity levels would continue to increase in the ponds closed to tidal influence. Ponds would be expected to dry out and water structures would deteriorate, ultimately reducing DFG's ability to manage water and salinity levels for wildlife. Habitat quality decline would result in reduced levels of resident and migrating wildlife, therefore resulting in decreasing recreational uses such as bird watching, hunting, and fishing. Thus, the No-Project Alternative conflicts with the Napa and Solano County recreation policies and the Bay Plan. Public access and mosquito abatement opportunities would remain unchanged, as existing access would be maintained and mosquito production would remain the same or possibly be reduced because of higher salinities. Views would also become degraded as a result of loss of habitat. There would be no impact on public access, mosquito abatement, or scenic vistas and therefore, this impact is considered less than significant.

15.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

15.2.3.1 Beneficial Impact R-1: Enhanced Recreational Opportunities

As described in Chapter 6, "Biological Resources—Wildlife," and Chapter 7, "Biological Resources—Aquatic Resources," a number of species would benefit from an increase in suitable habitat provided by the salinity reduction process. Overall, as habitat quality increases, the recreational potential of the project site would increase. The public is expected to be attracted to the site as species populations and composition increase. Specifically, recreational use of the site for bird watching, hunting, and fishing is expected to increase.

Pond 2 would not be affected by the salinity reduction process. Pond 2 would continue to be managed as a deepwater pond. Therefore, the Can Duck Club would benefit by this option as overall quality of the site improves because as the habitat quality increases, more waterfowl would be attracted to the site. However, the Can Duck Club lease will be terminated in 2007, and public hunting will be allowed. The private duck club near Pond 6A would also benefit by the improved habitat quality.

This option is in compliance with Napa County and Solano County recreation policies and the Bay Plan. The Bay Plan designates the project site as a wildlife area and managed wetlands, which is in accordance with the goals of the project.

This option would improve recreational potential. This impact is considered beneficial. No mitigation is required.

15.2.3.2 Impact R-2: Consistency with Existing or Proposed Public Access Plans

Proposed alignments of the Bay Trail are located along the northern and eastern periphery of the NSMWA. Therefore, implementation of this option would not conflict with the Bay Trail. Given the proximity of the Bay Trail, the NSMWA might serve as a destination for Bay Trail users. The Bay Plan designates the project site as a wildlife area and managed wetlands, which is in accordance with the goals of the project. This option would be in compliance with the proposed recreation and public use plan because this project would be integrated into it. This impact is considered less than significant. No mitigation is required.

15.2.3.3 Impact R-3: Accelerated Physical Deterioration of a Recreational Facility or Adverse Effects from Facility Expansion

Reduction of salinity in ponds would improve habitat quality for many species. As habitat improves and the visual quality of the site increases, recreational uses are expected to increase. DFG would upgrade existing recreation facilities as needed to maintain the recreational facilities of the NSMWA (Wyckoff pers. comm.). This impact is considered less than significant. No mitigation is required.

15.2.3.4 Impact R-4: Temporary Effect of Construction on Public Access

Public access would be limited during construction. The public would be restricted from accessing the levee road along Ponds 7 and 7A and from navigating portions of Napa Slough. Access to the project site where heavy equipment is being operated, specifically during the construction of water control structures at Ponds 3, 4, 5, and 6A and maintenance of levees on Ponds 1, 1A, 2, 6/6A, 7, 7A, and 8, also would be restricted. Access to water control structures and monitoring equipment would be restricted as well.

Restricted access would be limited to specific areas surrounding the construction activities and would last for several months. A small portion of the NSMWA

would require restricted access. The public would have access to the majority of the site and NSMWA during construction activities. Once the activities are completed, previous public access would resume. This impact is considered less than significant. No mitigation is required.

15.2.3.5 Impact R-5: Substantial Adverse Effect on a Scenic Vista

Construction activity, such as the operation of heavy equipment and material storage, would temporarily change the visual character of the area; however, these effects would be temporary and the project is not located in a designated scenic area. It is anticipated that areas disturbed by construction activities would revegetate naturally. Therefore, construction would not cause a permanent effect on the aesthetic quality of the area. This impact is considered less than significant. No mitigation is required.

15.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Beneficial Impact R-1and Impacts R-2, R-3 and R-5. Impact R-4 is lessened because there would be less construction; it remains less than significant. As described in Impact R-6, Salinity Reduction Option 1B c~~w~~ould increase mosquito production.

15.2.4.1 Impact R-6: Increased Mosquito Production

While one of the goals of this salinity reduction option and the habitat restoration options is to achieve full tidal exchange in selected ponds, preliminary modeling efforts show that creation of some nontidal, stagnant areas may occur. Increased tidal muting would result in an increase in mosquito production.

However, mosquito reproduction is prevented in ponds by California cord grass growth, and the project area contains one of the Bay Area's best remaining stands of this species, on Coon Island. Because areas of new sedimentation are generally colonized by the species of plants that already inhabit the area, California cord grass is expected to colonize the project's newly created shallow-water ponds. This was the case when Pond 2A was restored to tidal action; as the sediments built up in the pond, California cord grass began to reestablish itself in the pond, and there have been no mosquito problems in that pond.

However, because of the possibility that California cord grass would not colonize some areas, it could take longer for some ponds to become restored, and these ponds could become a problem source of mosquitoes. In that event, NCMAD

would need to increase abatement activities. This impact is considered significant. Implementation of Mitigation Measure R-1 would reduce this impact to a less-than-significant level.

Mitigation Measure R-1: Coordinate Project Activities with the Napa County Mosquito Abatement District

The project sponsors will coordinate with NCMAD during the design, implementation, and operations phases of the project. Specifically, they will

- consult with NCMAD during the project design phase to incorporate design elements to reduce the mosquito production potential of the project;
- permit NCMAD to have access to the project area to monitor or control mosquito populations;
- consult with NCMAD regularly to identify mosquito management problems, mosquito monitoring and abatement procedures, and opportunities to adjust water management practices in nontidal wetlands to reduce mosquito production during problem periods; and
- consult with NCMAD to identify opportunities for DFG to share costs, obtain the necessary permits from the Corps, BCDC, the San Francisco Bay RWQCB, and USFWS, and otherwise participate in implementing mosquito abatement programs, if it is necessary for NCMAD to increase mosquito monitoring and control programs beyond preproject levels.

15.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Salinity Reduction Option 1C is nearly the same as Salinity Reduction Option 1B except that more levees would be breached. The impact conclusions and mitigation are the same.

15.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts R-2, R-4, and R-5. Impact R-3 is slightly different and is described below.

15.2.6.1 Impact R-3: Accelerated Physical Deterioration of a Recreational Facility or Adverse Effects from Facility Expansion

Ponds 1, 1A, and 2 would be temporarily affected by increased levels of salinity. Increased salinity levels could adversely affect wildlife and fish populations and thus recreational activities. However, in the long term, salinity levels of Ponds 1, 1A, and 2 would begin to decrease as salinity in the upper ponds begins to decrease in less than 10 years. This option would degrade recreational opportunities in the short term by degrading habitat quality for a large number of species, then would enhance habitat and opportunities in the long term. Because of the numerous other hunting, fishing, and birdwatching opportunities within a short distance of the project area and the long-term habitat values provided by the project, this impact is considered less than significant. No mitigation is required.

15.2.7 Water Delivery Option

15.2.7.1 Impact R-5: Substantial Adverse Effect on a Scenic Vista

Water Delivery Project Component (Sonoma Pipeline)

Activity associated with construction of the Sonoma Pipeline, such as the operation of heavy equipment and material storage, would change the visual character of the area; however, these effects would be temporary. ~~It is anticipated that~~The areas disturbed by construction activities would be returned to preproject conditions or better at the end of the proposed construction activities (i.e., at the completion of construction activities, previously vegetated areas would be reseeded); therefore, construction would not cause a permanent effect on the aesthetic quality of the area. This impact is considered less than significant. No mitigation is required.

Water Delivery Project Component (Napa Pipeline)

Construction activity along the Napa Pipeline alignment, such as the operation of heavy equipment and material storage, would change the visual character of the area. Similar to impacts of the Sonoma Pipeline, these impacts would be temporary. The Napa alignment does, however, border comparatively more occupied areas. While there would be residents who would be able to view the construction activity, such activity would not cause a permanent effect on the aesthetic quality of the area. The pipeline would be placed below ground and the surface restored after construction is completed (i.e., previously vegetated areas would be reseeded and previously paved areas would be repaved). This impact is considered less than significant. No mitigation is required.

Project Component (CAC Pipeline)

Similar to the Napa Pipeline alignment, the CAC Pipeline alignment borders areas where residents would be able to view the construction activity. The construction activity, including operation of heavy equipment and material storage, would change the visual character of the area. These impacts, however, would be temporary. Such construction activities would not cause a permanent effect on the aesthetic quality of the area. The pipeline would be placed belowground and the surface restored after construction is completed (i.e., previously vegetated areas would be reseeded and previously paved areas would be repaved). This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated, however, that construction-related visual resources impacts of the Program Component would be comparable to those described above for the Project Component. Based on preliminary alignment configurations, construction corridors would border sections of residential, commercial, agricultural, and industrial land uses. As described above, views may be temporarily affected by the presence of heavy machinery or on-site storage of soil, pipeline, or other related material. ~~It is anticipated that t~~These views would be restored to preproject conditions upon completion of construction. The permanent piece of the project, the pipeline, would be underground and out of view, therefore not causing a lasting visual resource impact. This impact is considered less than significant. No mitigation is required.

15.2.7.2 Impact R-7: Short-Term Conflicts with Existing or Proposed Recreational Use and Recreation Policies

Water Delivery Project Component (Sonoma Pipeline)

The Sonoma Pipeline alignment would occur along a railroad ROW. South of the proposed pipeline alignment, beyond the railroad ROW, is the Huichica Creek Unit, a wildlife preserve that can be accessed only at Buchli Station Road at the east end of the alignment. The pipeline would be placed beneath Buchli Station Road where a parking lot is located. Access may be limited for a period of time until the construction crews complete the pipeline in the area. Buchli Station Road in the project area is a road used specifically for access to the salt marshes and is lightly traveled, with access limited to, or through, DFG personnel. The Sonoma Pipeline alignment also would cross south of a parking lot that serves as an access point to the Ringstrom Bay Unit. Access may be

limited temporarily while construction crews are in the immediate area. This impact is considered significant. Implementation of Mitigation Measure R-2 would reduce this impact to a less-than-significant level.

Mitigation Measure R-2: Prepare a Public Access Plan
Before beginning construction, the contractor will develop, in consultation with the appropriate representative(s) of DFG, a plan indicating how public access to the Napa River Unit will be maintained during construction. If needed, flaggers will be stationed near the construction activity area to direct and assist members of the public around the activity areas while maintaining access to the Napa River Unit.

Project Component (Napa Pipeline)

Similar to the Sonoma Pipeline, the Napa Pipeline alignment would be placed beneath Buchli Station Road. This road is used for access to DFG's Huichica Creek Unit of the NSMWA. Access may be limited for a period of time until the construction crews complete the pipeline in the area. This impact is considered significant. Implementation of Mitigation Measure R-2, "Prepare a Public Access Plan," described above under the Sonoma Pipeline would reduce this impact to a less-than-significant level.

Water Delivery Project Component (CAC Pipeline)

The CAC Pipeline alignment would extend down Green Island Road, which is bordered by residential, commercial, and industrial land uses. Mezzetta Road is bordered by industrial land uses. There are no recreational facilities in the immediate area. The nearest community park is approximately 0.5 mile south of Green Island Road and would not be affected by project construction. There would be no impact. No mitigation is required.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. Based on preliminary alignment configurations for the Program Component, construction corridors would have the potential to affect access to recreational facilities. There are many facilities near the proposed alignments, as outlined above, such as Deer Island Open Space Preserve. During construction along SR 37, access to Deer Island Lane, an entranceway to the preserve, may be limited. Additional recreational facilities, such as wineries located along Lakeville Road and Sears Point Raceway, could also potentially be affected by limited access as a result of construction. These facilities, while not publicly owned, provide recreational uses for the public. This impact is considered a significant impact. Implementation of Mitigation Measure R-2, "Prepare a Public Access Plan," would reduce this impact to a less-than-significant level. This measure is described under "Water Delivery Project Component (Sonoma Pipeline)" above.

15.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 are nearly the same as those under Salinity Reduction Option 1A for Impacts R-1, R-2, R-3, and R-4 and Salinity Reduction Option 1B for Impact R-6. The effects on existing recreation and the effects of temporary construction on public access differ slightly from those discussed under Salinity Reduction Option 1A. Beneficial Impact R-8, an impact on visual resources described below, is unique to the habitat restoration options.

15.2.8.1 Beneficial Impact R-8: Enhancement of Existing Visual Character

Visual resources would be beneficially affected by the restoration of habitat in the Napa River Unit. Views from the scenic roadway SR 37 and from I-80 near American Canyon would be enhanced with the improvement of habitat quality, and the habitat would be more diverse and visually appealing. More wildlife would be visible, and the project would not create any nighttime glare or impede the quality of the scenic vista. This impact is considered beneficial. No mitigation is required.

15.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts R-2, R-3, and R-4; Salinity Reduction Option 1B for Impact R-6; and Habitat Restoration Option 1 for Beneficial Impact R-8. Impact R-9 is unique to this option and is described below.

15.2.9.1 Impact R-9: Conflict with Existing or Proposed Recreational Uses, or Recreation Plans and Policies

As described in Chapter 6, "Biological Resources—Wildlife," and Chapter 7, "Biological Resources—Aquatic Resources," restoration would improve wildlife habitat. As wildlife populations increase, recreation opportunities related to wildlife would increase, such as bird watching, hunting, and fishing. Species dependent on tidal marsh habitat would benefit from this option.

Management of Pond 2 as a deepwater pond would continue in the short term. In the long term, however, the eastern half of Pond 2 would evolve to tidal marsh. Duck hunting activities would likely be reduced or eliminated in this half of Pond

2. Even if hunting is possible, wooden duck blinds located on this portion of the pond would be affected. These duck blinds could be subject to instability based on tidal influence. While Pond 2 may decrease habitat used by waterfowl, the restoration of Ponds 7, 7A, and 8 would provide potential waterfowl habitat. Ponds 6 and 6A would also become evolving tidal marsh. The net effect on waterfowl is uncertain; however, DFG would continue to manage for multiple uses, including hunting, and the project sponsors would monitor waterfowl use of the project area. As proposed, Habitat Restoration Option 2 does not conflict with existing or proposed recreational uses or recreational plans and policies. This impact is considered less than significant. No mitigation is required.

15.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 are nearly the same as those under Salinity Reduction Option 1A for Impacts R-2, R-3, and R-4; Salinity Reduction Option 1B for Impact R-6; and Habitat Restoration Option 1 for Beneficial Impact R-8.

15.2.11 Habitat Restoration Option 4: Accelerated Restoration

Habitat Restoration Option 4 is nearly the same as Habitat Restoration Option 1, except that Habitat Restoration Option 4 includes design features that would accelerate the restoration process. Impacts under Habitat Restoration Option 4 are nearly the same as those under Salinity Reduction Option 1A for Impacts R-2, R-3, and R-4; Salinity Reduction Option 1B for Impact R-6; and Habitat Restoration Option 1 for Beneficial Impact R-8.

Chapter 16

Cultural Resources

16.1 Environmental Setting

16.1.1 Introduction and Sources of Information

This chapter addresses the cultural resources in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information on existing conditions is derived from the following sources:

- field surveys;
- a detailed historical records search;
- personal communications with the site manager, Native American tribes, and historical organizations;
- a review of historical literature; and
- additional research.

Cultural resources is the term used to describe several different types of properties: prehistoric and historical archaeological sites; architectural properties, such as buildings, bridges, and infrastructure; and resources of importance to Native Americans.

Historical resource is a CEQA term that includes buildings, sites, structures, objects, or districts, each of which may have historical, prehistoric, architectural, archaeological, cultural, or scientific importance, and is eligible for listing or is listed in the California Register of Historical Resources.

16.1.2 Regulatory Setting

16.1.2.1 Federal

National Historic Preservation Act and National Environmental Policy Act

The use of federal funding, or application for a federal permit, for the project triggers NEPA and Section 106 of the National Historic Preservation Act (NHPA) (36 CFR *et seq.*). According to both laws, the two compliance processes can be coordinated. The regulations and guidance outlined in the NHPA are being followed because NEPA regulations do not contain guidance on cultural resource issues.

Section 106 of the NHPA requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on these actions. The Section 106 process has six basic steps:

- initiate consultation and public involvement;
- identify and evaluate historic properties;
- assess effects of the project on historic properties;
- consult with the State Historic Preservation Officer (SHPO) regarding adverse effects on historic properties, resulting in a Memorandum of Agreement (MOA);
- submit the MOA to the ACHP; and
- proceed in accordance with the MOA.

The assessment of impacts presented in this chapter applies the Criteria of Effect and Adverse Effect, as defined by the NHPA. Because these criteria are consistent with the criteria for determining impacts for both CEQA and NEPA, this chapter will be used to document the effects of the project for the purpose of CEQA, NEPA, and Section 106.

Specific regulations regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency (in this case, the Corps) is ultimately responsible for ensuring that the Section 106 process is completed according to statute.

National Historic Preservation Act Determination of Historical Significance

For federal projects, cultural resource significance is evaluated in terms of eligibility for listing in the National Register of Historic Places (NRHP). NRHP criteria for eligibility are defined below.

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and that:

- are associated with events that have made a contribution to the broad pattern of our history;
- are associated with the lives of people significant in our past;
- embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.4).

16.1.2.2 State

California Environmental Quality Act

CEQA requires that public or private projects financed or approved by public agencies assess the effects of the project on historical resources. Historical resources are defined as buildings, sites, structures, objects or districts, each of which may have historical, architectural, archaeological, cultural, or scientific significance.

CEQA requires that if a project results in an effect that may cause a substantial adverse change in the significance of a historical resource, alternative plans or mitigation measures must be considered; however, only *significant* historical resources need to be addressed.

The steps performed in a cultural resources investigation for CEQA compliance are typically as follows:

- Identify potential historical resources.
- Evaluate the eligibility of historical resources.
- Evaluate the effects of a project on all eligible historical resources.

CEQA Determination of Significant Historical Resources

CEQA guidelines define three ways that a property can qualify as a significant historical resource for the purposes of CEQA review: (1) if the resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR); (2) if the resource is included in a local register of historical resources, as defined in section 5020.1(k) of the Public Resources Code or identified as significant in a historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code unless the preponderance of evidence demonstrates that it is not historically or culturally significant; or (3) the lead agency determines the resource to be significant as supported by substantial evidence in light of the whole record (California Code of Regulations, Title 14, Division 6, Chapter 3, section 15064.5).

For a historical resource to be eligible for listing on the CRHR, it must be significant at the local, state, or national level under one or more of the following four criteria:

1. It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage ;
2. It is associated with the lives of persons important in our past.
3. It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual or possesses high artistic values or
4. It has yielded, or may be likely to yield, information important in prehistory or history.

Historical resources automatically listed in the CRHR include those historic properties listed in, or formally determined eligible for listing in, the NRHP (PRC Section 5024.1).

16.1.3 Regional Setting

San Pablo Bay and surrounding marshlands and uplands were used extensively by humans during prehistoric and historic times (See Jones & Stokes 2003 for detailed historical context). For several thousand years during prehistoric times, the Coast Miwok and the Patwin Indians lived in areas surrounding San Pablo Bay. These native cultures subsisted on hunting, gathering, and fishing in San Pablo Bay, bay margins, and uplands. Settlement by Europeans and Spanish in the late 1700s and early 1800s began to affect these native peoples adversely, and these populations were decimated by the early 1900s.

Early settlement of Napa, Sonoma, and Solano Counties led to large land grants and new land uses. The San Pablo Bay tidelands remained undeveloped for the 1850s and 1860s but were transformed in the 1870s with the reclamation of much of the tideland under the 1868 Green Act. By the early twentieth century levees enclosed nearly all of the San Pablo Bay marshes (Hayes 1995, Kelley 1989).

New land uses included ranching, duck hunting, urban infrastructure such as roads, and salt production.

At the time of Euroamerican contact, the two Native American groups lived in the area. The Patwin spoke suskol, while huchi was one of the languages spoken by the Coast Miwok. Native American archaeological sites in the project area portion of Sonoma and Napa Counties tend to be situated along the bases of hills and alluvial flats, in areas along the edge of the marsh/slough system.

16.1.4 Project Setting

16.1.4.1 Restoration Area of Potential Effect

The restoration Area of Potential Effects (APE) was delineated by the Corps on October 2, 2002 (Figure 16-1). The APE includes all areas of the project area where ground-disturbing activities are anticipated, including levee breaches.

On April 25, and October 15, 2002, Jones & Stokes conducted a survey of the project area. As part of the field process, buildings and structures in the project area were photographed and notes were taken. During the site visit 14 historic resources were observed that appear to be more than 50 years old. These resources were recorded on Department of Parks and Recreation 523 forms (DPR 523 forms) and evaluated for the NRHP and CEQA. The DPR 523 forms are attached to the technical report (Jones & Stokes 2003).

16.1.4.2 Restoration Area Archaeology

Several archaeological sites have been recorded within a 1-mile radius of the restoration APE; however no known archaeological sites have been recorded within the project area. Several cultural resources studies have been conducted in the area surrounding the project area, including reports produced by David A. Fredrickson in 1983, Mick Hayes in 1995, and Nicholas Valentine in 1997. Fredrickson's 1983 report discusses how environmental elements played a crucial role in the development of cultural settlement and land use patterns in the project area and surrounding region. Valentine's 1997 cultural resources report mentions that the Napa Marsh would have been a plentiful area for prehistoric subsistence and undoubtedly received heavy usage (Valentine 1997: 3).

Several prehistoric sites have been identified within a ½-mile radius of the restoration APE. Nels Nelson first identified CA-SOL-269~~,~~ and 230 in the early 20th century. CA-SOL-269 is a low mound approximately 100 feet by 50 feet in size located on the eastern banks of the Napa River on Slaughterhouse Point. CA-SOL-269 is located northeast of the APE and consists of a light surface scatter of obsidian and quartz flakes. CA-NAP-230 consists of the remains of numerous shell fragments and obsidian flakes on the northwest edge of Green Island. Several additional isolated finds of prehistoric materials have been reported to the Northwest Information Center (NWIC) and are in the vicinity

of the project area. Additionally, Tom Huffman from DFG reported that he identified a charmstone and an obsidian projectile point on the surface of one of the levées within the project area (Huffman pers. comm.).

No archaeological sites were observed during the site visit; however, a formal archaeological survey of the restoration APE was not conducted because the majority of the project area is completely inundated and levees are not part of the natural environment. A qualified archaeologist conducted a sample survey of accessible locations within the restoration APE during the site visits in May and October 2002. However, because several prehistoric sites are located within a 1-mile radius of the project area, the identification of prehistoric materials by Tom Huffman, and the extensive historical occupation and land use, the project area could contain prehistoric and historic archaeological resources.

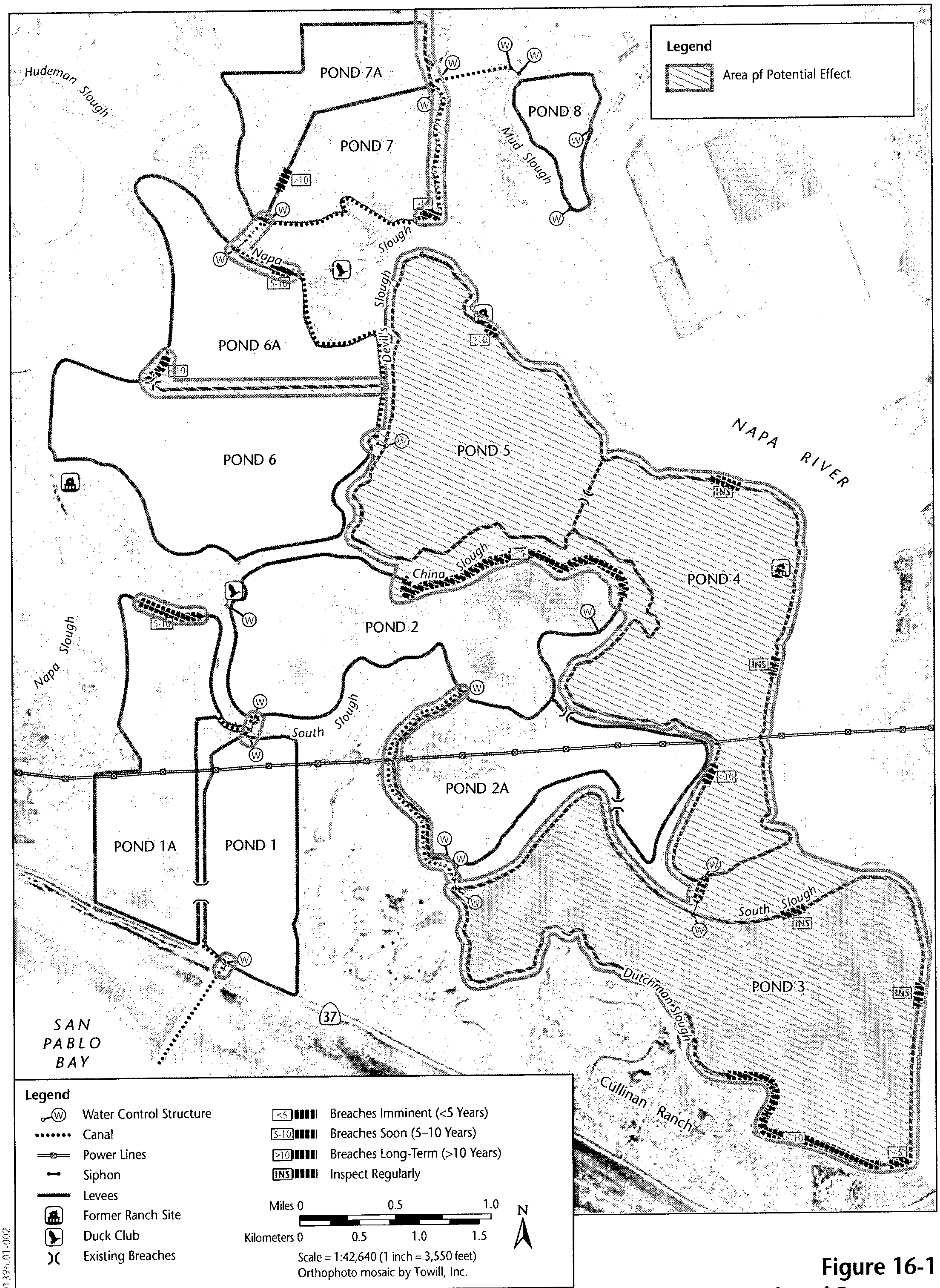
16.1.4.3 Restoration Area Built Environment

Hayes (1995) and Valentine (1997) identified two historic properties (the Detian/Fleishacker Duck Club and associated structures and the Cullinan Ranch and associated levees) in the vicinity of the project area and determined that neither resource met NRHP eligibility requirements.

A total of twelve buildings, structures, and linear features more than 50 years old located within the restoration APE have been identified and evaluated for historical significance. None of the resources evaluated appear to be historically or architecturally significant. A brief description and evaluation of NRHP and CRHR eligibility for each historic resource and linear feature is presented below. (See Jones & Stokes 2003 for DPR records).

Duck Blinds and Fishing Sheds

A total of three duck blinds and two fishing sheds are located in the project area. The structures are generally small (covering 40-80 feet) wood frame structures supported by post-and-pier or wood pilings. The blinds and sheds are typically clad with plywood, shingled, or corrugated metal and roof forms are either gabled, flat, or shed style. They include window and door openings and walkways with rails and often feature wood piers. One duck blinds is a converted abandoned fishing boat that was permanently moored in the marsh. Most structures are somewhat deteriorated and are partially collapsed and/or missing siding. According to historic maps the duck blinds and fishing sheds in the project area date from approximately the 1930s to the 1950s. The duck blinds and fishing sheds located in the project area lack integrity and therefore do not appear to meet the criteria for listing in the NRHP or the CRHR.



Jones & Stokes

Figure 16-1
Cultural Resources
Area of Potential Effect for Restoration Area

Farming and Ranching Building Remains

Farm and ranch building remnants are located in the project area. These remains are ~~comprised~~ composed of concrete foundations with heavily deteriorated wood structures. The remains were once part of a complex of buildings constructed in the mid-twentieth century for ranching and dairying purposes. The remains lack historical significance and therefore do not appear to meet the criteria for listing in the NRHP or the CRHR.

Wharf and Dock Remains

Wharf and dock remnants are located throughout the project area. The remnants originally accessed duck blinds and fishing sheds that are no longer in existence. The remains are in various stages of deterioration, are typically ~~comprised~~ composed of vertical wood posts with plywood, and vary in length from approximately two to fourteen feet. The remains lack historical significance and therefore do not appear to meet the criteria for listing in the NRHP or the CRHR.

Pump House

A pump house is located in the project area. The tower is a tall, gabled roofed building with wood siding. The building was constructed in the early 1950s and is still in use. The water tower lacks historical and architectural significance and therefore does not appear to meet the criteria for listing in the NRHP or the CRHR.

Levee and Slough System

The levee and slough system consists of several earthen levees, canals, and sloughs. According to historic maps by 1915, most of the tidelands area was reclaimed for agricultural use. The levee and slough system lacks integrity, and for this reason, it does not appear to meet the criteria for listing in the NRHP or the CRHR.

Salt Ponds

Eleven large salt ponds are located throughout the project area. The salt ponds were created in the area in the mid-twentieth century and continued to be used until the 1990s. The ponds lack historical significance and for this reason, they do not appear to meet the criteria for listing in the NRHP or the CRHR. ~~Water Conveyance Structure~~

Water Conveyance Structure

A water conveyance structure is located at the southern edge of Pond 1. The rectangular structure is ~~comprised~~ composed of wood plank boards and is supported by a wood-frame foundation. A large discharge pipe extends from the structure to San Pablo Bay. The water conveyance structure was constructed in the early 1950s. The structure lacks historical significance and therefore does not appear to meet the criteria for listing in the NRHP or the CRHR.

16.1.4.4 Water Delivery Project Component Area of Potential Effect

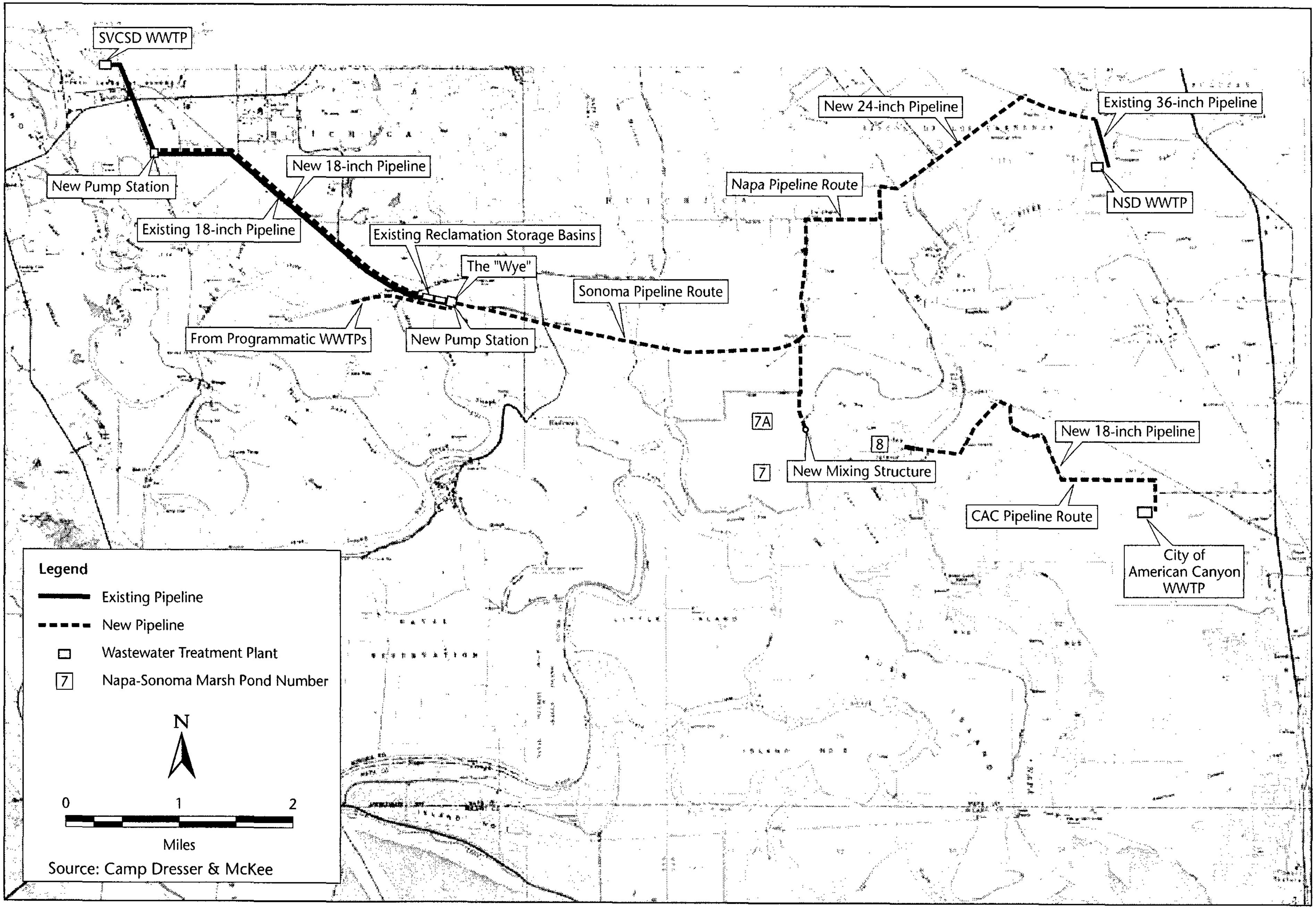
The pipeline APE was delineated in February 2003 (Figure 16-2) and includes all areas of the project where ground disturbing activities are anticipated, including new trenching for the pipeline and staging areas.

A records search conducted at the Northwest Information Center on February 25, 2003, indicated that there were three prehistoric resources located within the APE. A field survey was conducted on February 26, 2003, by qualified Jones & Stokes archaeologists. ~~No archaeological remains were identified during the cultural resources inventory; however, efforts were made to relocate sites CA-NAPSON-224, unnumbered Nelson's shell mound (C-164), and CA-NAP-230. No evidence of CA-NAPSON-224 was identified on the surface of the project area, and the topographic features discussed by Nelson in 1907 are no longer visible on the landscape. The area surrounding the location of CA-NAPSON-224 has been highly disturbed by agricultural activities and more recent off road vehicle use. Both locations for unnumbered Nelson's shell mound (C-164) were intensively surveyed for any sign of archaeological remains; however, none were visible on the surface. The locations for unnumbered Nelson's shell mound have been disturbed by the installation of previous water pipelines and a fiber optic line. No evidence of CA-NAP-230 was found other than scattered flakes of obsidian and shell fragments. The pipeline APE does not contain built environment resources.~~

Sonoma Pipeline Archaeology

Several prehistoric sites appear to be located in or immediately adjacent to the Sonoma pipeline APE. Two prehistoric shellmound sites recorded by Nels Nelson in 1907 appear to be in or immediately adjacent to the pipeline APE. CA-SON-224 is a shellmound located east of Schnell Creek. The site was originally recorded in 1907 by Nels Nelson and was described as a "campsite" consisting of "a circular prominence 30–35 feet in diameter and 1 to 1-1/2 feet high. Shell is almost absent but 2 or 3 obsidian flakes were found."

Unnumbered Nelson's shell mound was identified by Nels Nelson in 1907 and described the site as a campsite with " peculiar circular rises in the surface." No description was given of artifacts or size of this site. However, an isolated find



Jones & Stokes

Figure 16-2
Cultural Resources Area of Potential Effect for Water Delivery Option: Project Component

(C-164) by Sonoma State University archaeologists in 1987 may indicate the original location of the unnumbered Nelson's shell mound. Unnumbered Nelson's shell mound appears to have been incorrectly plotted and the isolated find, recorded as C-164, in an adjacent similar location has topographic features similar to those described by Nelson and is most likely unnumbered Nelson's shell mound according to the NWIC researchers. Both potential locations for unnumbered Nelson's shell mound appear to be within the pipeline APE. (The specific locations of these sites cannot be provided in a figure in the ~~EIR~~EIS because of the sensitive nature of the resource.)

CA-NAP-225, a prehistoric shellmound, was recorded by Nelson in 1907 and is located 75–100 feet northeast of the APE.

Approximately six archaeological studies were conducted between 1975 and 1994 that surveyed the current project APE. No archaeological remains were identified during the previous investigations in the APE.

No archaeological remains were identified during the cultural resources inventory; however, efforts were made to relocate sites CA-SON-224, and unnumbered Nelson's shell mound (C-164). No evidence of CA-SON-224 was identified on the surface of the project area, and the topographic features discussed by Nelson in 1907 are no longer visible on the landscape. The area surrounding the location of CA-SON-224 has been highly disturbed by agricultural activities and more recent off road–vehicle use. Both locations for unnumbered Nelson's shell mound (C-164) were intensively surveyed for any sign of archaeological remains; however, none were visible on the surface. The locations for unnumbered Nelson's shell mound have been disturbed by the installation of previous water pipelines and a fiber optic line. The pipeline APE does not contain built environment resources.

Napa Pipeline Archaeology

No historic resources have been previously identified in the pipeline APE; however, a historic ranch complex, Stanly Ranch, is located adjacent to the Napa pipeline. No signs of archaeological remains were identified in the Napa portion of the pipeline APE.

CAC Pipeline Archaeology

CA-NAP-230 appears to be located adjacent to the western end of the pipeline alignment. This site was recorded by Nels Nelson in 1907 and includes the remains of numerous shell fragments and obsidian flakes on the northwest edge of Green Island. The area has been heavily disturbed and is currently a residential complex with several houses and associated structures. CA-NAP-230 is located on Green Island located under the residential complex of the Cargill caretaker. No evidence of CA-NAP-230 was found other than scattered flakes of

obsidian and shell fragments. ~~No signs of archaeological remains were identified in the APE.~~

16.1.4.5 Water Delivery Program Component Area

A records search and cultural resource surveys have not been conducted for the program component area, but would be conducted as part of further environmental analysis, should efforts progress on the Water Delivery Program Component.

16.2 Environmental Impacts and Mitigation Measures

16.2.1 Methodology and Significance Criteria

Information on cultural resources in the project area was gathered by completing a records search, contacting the Native American Heritage Commission (NAHC) and Native American representatives with interest in the project area, contacting local historical organizations, conducting site visits~~,~~ and resource surveys, and conducting archival research to prepare a detailed historical context of the project area.

A records search was conducted at the NWIC of the California Historical Resources Information System in April 2002 and February 2003. The records search covered the entire project area and a ½-mile radius. The state database of previous studies and previously recorded cultural resources sites were consulted. Additional sources consulted included the NRHP, the California Inventory of Historic Resources, California Historical Landmarks, and California Points of Historical Interest.

The NAHC was contacted in April 2002 and asked to review its sacred lands file and provide a list of Native American representatives potentially interested in the project area. In May 2002, letters briefly describing the project, including a map of the project area, were sent to six Native American representatives. The letters requested that the representatives provide comments and express any concerns about the project. To date, no comments or concerns have been received. Follow-up letters and telephone calls to the Native American representatives were made in October 2002. Follow-up letters were sent in March 2003 updating the Native American Representative on the pipeline portion of the project.

Cultural resources staff initiated consultation with historical organizations in Napa and Solano Counties, including the Napa Historical Society, Napa Cultural Heritage Commission, Vallejo Archaeological Heritage and Landmarks Commission, and the Solano County Historical Society. Letters were sent to the

above organizations in May 2002 and follow-up telephone calls are also complete~~in progress~~.

In addition, cultural resources staff conducted archival research at the California State Library, Sacramento, the Sonoma State University library in Rohnert Park, the Sonoma Valley Historical Society, the Depot Park Museum in Sonoma, and the Sonoma Ecology Center in Sonoma in an effort to identify important historic people, events, and architectural trends that may have been associated with the project area. In addition, previous reports were consulted including the *Hamilton Wetland Restoration Plan and Final Environmental Impact Report/Environmental Impact Statement, Marin County, California* (Jones & Stokes 1998), the *Cultural Resources Inventory Report for Habitat Mitigation Planning Sites, San Francisco International Airport Proposed Runway Configuration Program* (Jones & Stokes 2000), and *Bel Marin Keys Environmental Impact Report* (Jones & Stokes 2002)

16.2.1.1 Criteria for Determining Effects under CEQA

The project would have a significant impact on cultural resources if it would

- cause a substantial adverse change in the significance of a historical resource as defined in section 15064.5,
- cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5,
- directly or indirectly destroy a unique paleontological resource or site or unique geologic feature, or
- disturb any human remains, including those interred outside of formal cemeteries

Actions that would materially impair the significance of a historic resource are any actions that would demolish or adversely alter those physical characteristics of a historic resource that convey its historical significance and qualify it for inclusion in the CRHR or in a local register or survey that meet the requirements of sections 5020.1(k) and 5024.1(g) of the Public Resources Code.

16.2.1.2 Criteria for Determining Effects under Section 106

Under federal regulations, a project has an effect on a historic property when the undertaking could alter the characteristics of the property that may qualify the property for inclusion in the NRHP, including alteration of location, setting, or use. An undertaking may be considered to have an adverse effect on a historic property when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to

- physical destruction or alteration of all or part of the property;

- isolation of the property from or alteration of the property's setting when that character contributes to the property's qualifications for listing in the NRHP;
- introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting;
- neglect of a property resulting in its deterioration or destruction; or
- transfer, lease, or sale of the property (36 CFR 800.9).

16.2.2 No-Project Alternative

16.2.2.1 Impact C-1: Potential to Materially Impair Significant Cultural Resources

Historical and archaeological resources in the project area would continue to deteriorate under the No-Project Alternative. Structures such as water control facilities, small wharfs and docks, fishing sheds, duck blinds, farming and ranching remains, and other post-settlement land uses would continue to age and deteriorate. None of the resources located in the project area appear to meet the criteria for listing in the NRHP or the CRHR, therefore, this impact is not considered significant.

16.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

16.2.3.1 Impact C-1: Potential to Materially Impair Significant Cultural Resources

The field surveys and a literature review of the project area indicate that there are 24 cultural resources within the project area. None of the resources located in the project area appear to meet the criteria for listing in the NRHP or the CRHR, therefore, this impact is not considered significant.

16.2.3.2 Impact C-2: Potential for Ground-Disturbing Activities to Damage Previously Unidentified Buried Cultural Resources Sites

Buried or otherwise unidentified cultural resources could be inadvertently unearthed during ground-disturbing activities, which could result in the demolition of or substantial damage to significant cultural resources. This impact is considered significant. Implementation of Mitigation Measure C-1 would reduce this impact to a less-than-significant level.

Mitigation Measure C-1: Stop Work If Cultural Resources Are Discovered during Ground-Disturbing Activities

If buried cultural resources, such as chipped or ground stone, historic debris, building foundations, or non-human bone are inadvertently discovered during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified archaeologist can assess the significance of the find and, if necessary, develop appropriate treatment measures. Treatment measures are measures that mitigate impacts through data recovery programs such as excavation or detailed documentation.

If cultural resources are discovered during construction activities, the construction contractor and lead contractor compliance inspector will verify that work is halted until appropriate treatment measures are implemented. Concurrence of the project sponsors will be obtained before resuming construction activities in the area of the find.

16.2.3.3 Impact C-3: Potential to Damage Previously Unidentified Human Remains

Buried human remains, if present, could be inadvertently unearthed during excavation activities, which could result in damage to these remains. Therefore, this impact is considered significant. Implementation of Mitigation Measure C-2 would reduce this impact to a less-than-significant level.

Mitigation Measure C-2: Comply with State Laws Pertaining to the Discovery of Human Remains

If human remains are discovered or recognized during construction, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

- the coroner of Napa and/or Solano County has been informed and has determined that no investigation of the cause of death is required; and
- if the remains are of Native American origin,
  - the descendants of the deceased Native Americans have made a recommendation to the land owner or the person responsible for the excavation work, for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98, or
  - the California Native American Heritage Commission (NAHC) was unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the commission.

According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the NAHC and the project sponsors must comply with state and federal laws relating to the disposition of Native American burials.

16.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B (Impacts C-1, C-2, and C-3) are nearly the same as those under Salinity Reduction Option 1A. Though there would be less construction under this option, a breach of Pond 3 could adversely affect cultural resources if present. Operational effects would also be nearly the same. Mitigation measures would also be the same as with Option 1A.

16.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge and Breach of Pond 3 and Pond 4/5

Impacts under Salinity Reduction Option 1C (Impacts C-1 and C-2) are nearly the same as those under Salinity Reduction Option 1A. Though there would be the smallest amount of construction under this option, breaches on Pond 3 and Pond 4/5 could adversely affect cultural resources if present. Operational effects would also be nearly the same as Salinity Reduction Option 1A. Mitigation measures would also be the same as with Option 1A.

16.2.6 Salinity Reduction Option 2

Impacts under Salinity Reduction Option 2 (Impacts C-1 and C-2) are nearly the same as those under Salinity Reduction Option 1A. There would be additional construction under this option, and construction of the siphon between Pond 6 and Pond 2 ~~and canal widening south of SR 37~~ could adversely affect cultural resources if present. Operational effects would also be nearly the same. Mitigation measures would also be the same as with Option 1A.

16.2.7 Water Delivery Option

16.2.7.1 Impact C-4: Changes in the Significance of a Historic and/or Archaeological Resource

Water Delivery Project Component

Archaeological surveys in the project area did not identify archaeological remains along the Napa Pipeline or CAC Pipeline routes; however, there is the potential for construction of the Sonoma Pipeline to affect Site C-164 (unnumbered Nelson's shell mound), a shell mound with associated habitation debris.

Given that ~~both~~ all three pipeline routes are located in, or near, areas along or near marshes, sloughs, alluvial flats, and water environments, all of which are known areas of Native American habitation, there is a high possibility of encountering other Native American resources. Additionally, there is the potential of encountering historic archaeological sites or subsurface structures associated with the rail lines and ranch complex. As such, construction of the pipelines that are currently proposed for the Water Delivery Option could affect archaeological resources. This impact is considered significant. Implementation of Mitigation Measure~~s C-4~~C-3 would reduce this impact to a less-than-significant level.

Mitigation Measure C-3: Conduct Archaeological Monitoring of Construction Activities in the Vicinity of CA-NAP-224, C-164, and CA-NAP-230

For the three areas determined to have a high potential for containing archaeological resources, an archaeological monitor will be on site during initial grading/trenching activities of the subject areas to inspect for the presence of archaeological resources. In the event that archaeological resources are encountered, the monitor will have the authority to temporarily halt construction activities in the area of discovery to allow an archaeological testing program to record, collect, and evaluate the resources encountered. If the resource is determined to be significant for the NRHP and/or the CRHR, a data recovery program will be implemented. The collection of archaeological materials recovered during any additional site investigations, along with a testing report, will be deposited into a local qualified repository for retention and curation. A copy of the testing report will be deposited with the California Historical Resources Regional Information Center. Construction monitoring will include preparation of a report with appropriate graphics summarizing the results, analyses, and conclusions.

Should archaeological resources be identified, the archaeologist will evaluate the significance of the resource(s), conducting additional investigation if/as necessary, and will provide specific mitigation recommendations based on the significance of the resource. Development of the mitigation recommendations will incorporate the requirements of Section 21083.2 of CEQA pertaining to

archaeological resources. If the area of potential effect contains buildings, structures, or objects older than 45 years (the Office of Historic Preservation has determined that buildings, structures or objects older than 45 years may be of historical value), the agency responsible for compliance with Section 106 of the NHPA will consult with the state Office of Historic Preservation regarding potential impacts on these properties. Implementation of the mitigation measures will occur before, or in conjunction with, pipeline construction activities based on the recommendations of the archaeologist.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the potential future pipelines associated with the Water Delivery Program Component of the Water Delivery Option. Given that much of the area in the vicinity of the potential future pipelines is near marshes, sloughs, alluvial flats, and water environments, all of which are known areas of Native American habitation, there is a high likelihood that Native American resource sites are present in the general area and could be affected by pipeline construction activity. Also, in the absence of any information to indicate otherwise, there is the potential that historic resources are located in the general area. This impact is considered significant. Implementation of Mitigation Measure C-4 would reduce this impact to a less-than-significant level.

Mitigation Measure C-4: Conduct Records Search and Visual Survey
Before initiation of any grading or other surface disturbance activity for construction of each potential future pipeline, a records search for historic and cultural resources will be completed. A qualified archaeologist will conduct a field visual survey along the construction route of each pipeline to supplement the records search and provide a basis for determining whether significant resources exist. Based on the results of the records search and visual survey, and any additional investigation necessary to assess the presence and significance of onsite resources, mitigation will be provided. Development of the mitigation recommendations will need to incorporate the requirements of Section 21083.2 of CEQA pertaining to archaeological resources.

16.2.7.2 Impact C-5: Disturbance of Human Remains

Water Delivery Project Component

As discussed above, portions of the proposed pipeline alignments for the Water Delivery Option are along or near areas where the probability of encountering Native American resources is high. The Native American resources could include human remains. This impact is considered significant. Implementation of Mitigation Measure C-2, "Comply with State Laws Pertaining to the Discovery of Human Remains," would reduce this impact to a less-than-significant level. This measure is described under Impact C-3 above. Operation

of the proposed pipelines is passive; therefore, no impact is anticipated on human remains.

Water Delivery Program Component

Exact alignments and construction methods have not yet been determined for the pipelines associated with the Program Component of the Water Delivery Option. It is anticipated that the potential risk of encountering or disturbing human remains would be comparable to those described above for currently proposed pipelines. This impact is considered significant. Implementation of Mitigation Mitigation Measure C-2, "Comply with State Laws Pertaining to the Discovery of Human Remains," would reduce this impact to a less-than-significant level. This measure is described under Impact C-3 above.

16.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 are nearly the same as those described under Salinity Reduction Option 1A for Impacts C-2 and C-3, and similar to those described under Salinity Reduction Option 1B and 1C because exterior levees would be breached in both cases. However, more levees would be breached, and the breaches would be wider, under Habitat Restoration Option 1 than under Salinity Reduction Options 1B or 1C. In addition, several miles of levees would be lowered to elevations near MHHW. Impact C-1 is slightly different under this option and is described below.

16.2.8.1 Impact C-1: Potential to Materially Impair Significant Cultural Resources

Additional construction would be required to remove the intake and outfall facilities, downgrade levees, and construct ditch blocks. Furthermore, scouring and other elevation changes are anticipated and desired as part of marsh restoration during operation.

None of the cultural resources located in the project area appear to meet the criteria for listing in the NRHP or the CRHR, therefore, this impact is not considered significant. ~~Furthermore, because no project is being implemented, no mitigation is required.~~

Mitigation Measure C-45: Halt Construction if Cultural Resources Are Uncovered

If buried cultural resources are discovered during construction activities, the construction contractor and lead contractor compliance inspector will verify that work is halted until appropriate treatment measures are implemented.

Concurrence of the project sponsors will be obtained before resuming construction activities in the area of the find.

Mitigation Measure C-56: Include Archeological Monitoring for Sensitive Locations
For sensitive locations are identified in the inventory report, a qualified archaeological monitor should observe ground-disturbing activities associated with the project construction.

16.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

More levees would be breached under Habitat Restoration Option 2 than under Habitat Restoration Option 1, and the number of ponds open to the tidal prism is greatest under this option. However, impacts under Habitat Restoration Option 1 (Impacts C-1 and C-2) are nearly the same as those under Habitat Restoration Option 1. If necessary, Mitigation Measures C-5 and C-6 will be implemented under Option 2.

16.2.10 Habitat Restoration Option 3: Pond Emphasis

Fewer levees would be breached under Habitat Restoration Option 3 than under Habitat Restoration Option 1, and the number of ponds open to the tidal prism is least under this option. However, impacts under Habitat Restoration Option 3 (Impacts C-1 and C-2) are nearly the same as those under Habitat Restoration Option 1. If necessary, Mitigation Measures C-5 and C-6 will be implemented under Option 3.

16.2.11 Habitat Restoration Option 4: Accelerated Restoration

Additional levee lowering, channel excavation, and the use of fill material to accelerate restoration would occur under Habitat Restoration Option 4, potentially affecting significant cultural resources. However, impacts under Habitat Restoration Option 4 (Impacts C-1 and C-2) are nearly the same as those under Habitat Restoration Option 1. If necessary, Mitigation Measures C-5 and C-6 will be implemented under Option 4.

Chapter 17
Alternatives

17.1 Introduction

This chapter describes the alternative formulation and screening process, presents the project alternatives included for analysis, and summarizes and compares the environmental impacts of the No-Project Alternative and the project alternatives.

17.2 Alternative Formulation and Screening

NEPA and CEQA require the analysis of a range of alternatives. The project sponsors developed alternatives by combining the salinity reduction, water delivery, and habitat restoration options presented in Section 2.5 of Chapter 2, "Site Description, Options, and Alternatives."

Combining the four salinity reduction options, the water delivery option, and four habitat restoration options results in 16 possible alternatives. To ensure that a complete range of alternatives was analyzed, an additional alternative was added that does not use recycled water. With the No-Project Alternative, there are 18 possible project alternatives.

The project sponsors then screened these alternatives with respect to cost effectiveness, feasibility, and environmental impacts and achievement of overall project objectives for salinity reduction, water delivery, and habitat restoration. Table 17-1 shows the 18 alternatives, including the alternatives evaluated in this ~~EIR/~~EIS, and also cross-referenced alternatives as numbered in the Corps' Draft Feasibility Report. The No-Project Alternative was retained for detailed evaluation as required by CEQA and NEPA.

Table 17-1. Integration of Project Options to Create Project Alternatives

~~EIR~~/EIS Alternative Number	Salinity Reduction Option				Habitat Restoration Option				Recy. Water Use?	Feas. Report Alt. Number
	1A	1B	1C	2	1	2	3	4		
Alternatives Evaluated in the ~~EIR~~/EIS										
No-Project	NA	NA	NA	NA	NA	NA	NA	NA	No	1
1	X				X				Yes	2
2		X			X				Yes	6
3		X				X			Yes	7
4		X					X		Yes	8
5		X						X	Yes	9
6			X		X				Yes	10
7				X				X	Yes	17
8		X			X				No	-
Alternatives Eliminated from the Analysis in the ~~EIR~~/EIS										
9	X					X			Yes	3
10	X						X		Yes	4
11	X							X	Yes	5
12			X			X			Yes	11
13			X				X		Yes	12
14			X					X	Yes	13
15				X	X				Yes	14
16				X		X			Yes	15
17				X			X		Yes	16

17.2.1 Alternatives Screening

All but one of the alternatives involving Salinity Reduction Option 2 were eliminated from further consideration because they would not meet the project goal of managing salinity levels in ponds to support a rich diversity of biota. Most of the alternatives involving Salinity Reduction Option 2 were eliminated because they would increase salinity in existing ponds, lengthen the amount of time to achieve desired salinity levels, and degrade existing habitats in Ponds 1, 1A, and 2, and would be substantially more expensive to implement. Salinity Reduction Option 2, with a breach of Pond 3, recycled water delivery, and Habitat Restoration Option 4, was retained because it represents the fastest overall habitat restoration process. Although this alternative degrades the existing habitat in Ponds 1, 1A, and 2, it provides an alternative to discharging to Napa Slough.

The Project and Program Components of the Water Delivery Option were retained for most alternatives because of the high level of interest from local water agencies and the San Francisco Bay RWQCB, and availability and

suitability of this supply of water to accelerate restoration of the ~~u~~Upper ~~p~~Ponds. Although the program water delivery component is evaluated in general, subsequent environmental analysis would be conducted by SCWA before this component could be implemented.

All of the habitat restoration options were retained in at least one alternative. However, the project team screened out other combinations of salinity reduction and habitat restoration options to focus on Habitat Restoration Option 1 because it provides a mixture of pond and tidal marsh habitats, is the one that best meets the project goals, and is cost effective.

17.3 Alternatives Included for Analysis

Based on the above screening process, the following nine alternatives were included for detailed analysis:

- No-Project Alternative;
- Alternative 1: Napa River and Napa Slough Discharge (Salinity Reduction Option 1A), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 2: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 3: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Tidal Marsh Emphasis (Habitat Restoration Option 2);
- Alternative 4: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Pond Emphasis (Habitat Restoration Option 3);
- Alternative 5: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4);
- Alternative 6: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5 (Salinity Reduction Option 1C), Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1);
- Alternative 7: Napa River and San Pablo Bay Discharge and Breach of Pond 3 (slight modification of Salinity Reduction Option 2), Recycled Water Delivery, and Accelerated Restoration (Habitat Restoration Option 4); and
- Alternative 8: Napa River and Napa Slough Discharge and Breach of Pond 3 (Salinity Reduction Option 1B), No Recycled Water, and Mixture of Ponds and Tidal Marsh (Habitat Restoration Option 1).

The salinity reduction portion of Alternative 7 is slightly modified from Salinity Reduction Option 2 and includes a breach of Pond 3. These impacts are considered under analysis of this alternative.

17.3.1 Comparison of Alternatives

17.3.1.1 Project Features

Project features are summarized in Table 17-2. Alternatives 1–8 are considered "action" alternatives. Each action alternative provides a mix of pond and new tidal habitat. The No-Project Alternative provides no tidal habitat. All alternatives assume that Ponds 1 and 1A would remain as ponds, managed in the same manner as they are now. Similarly, all action alternatives retain Ponds 7, 7A, and 8 as ponds. Ponds 1, 1A, 7, 7A, and 8 are accessible by land and are smaller in area, and therefore more easily managed and maintained than the island ponds. All action alternatives would convert Ponds 3 and 4 to tidal habitat. These two ponds are large and immediately adjacent to the Napa River and have deteriorating levees. (As described in Section 2.5.2, "Salinity Reduction Options," Pond 3 is partially open to tidal exchange as a result of the ditches that were dug in August 2002.)~~, but salinity reduction of this pond still needs to be conducted.)~~ All action alternatives except Alternative 4 also would convert Pond 5 to tidal habitat.

Under all action alternatives except Alternatives 3 and 4, Pond 6/6A could be restored to tidal habitat based on adaptive management considerations 10–20 years after Pond 3 is opened to tidal action. Alternative 3 would convert Ponds 6, 6A, and the eastern portion of Pond 2 (Pond 2E) to tidal habitat shortly after Ponds 3, 4, and 5 are opened to tidal action. Ponds not opened to tidal action would be retained as managed ponds. Alternative 4 would convert Ponds 3 and 4 to tidal habitat. Ponds not opened to tidal action would be retained as managed ponds.

All action alternatives include initial levee repairs to upgrade levees to a minimum 20-year life. Initial levee repairs would be required at Ponds 1, 1A, 2, 7, 7A, and 8. Under all action alternatives, these ponds would be maintained as ponds in the long term. Under Alternative 3, only the western portion of Pond 2 (Pond 2W) would require initial repairs, but a new levee would need to be built between Ponds 2E and 2W. All action alternatives except Alternative 3 also require initial levee repairs at Ponds 6/6A. Alternative 4 additionally requires initial external levee repairs at Pond 5. All action alternatives ~~except Alternative 4~~ include the installation of four interior 100-foot breaches between Ponds 4 and 5 and between Ponds 6 and 6A to improve circulation within these two sets of linked ponds. Alternative 4 requires repair of the levee breaches in the Pond 4/5 interior levee prior to habitat restoration. No levee repairs or breaches would occur under the No-Project Alternative.

Alternative 1 includes water control structures on Pond 3, whereas all other action alternatives do not. This would require repairing the existing breach on South Slough and ditch to Ditchman Slough. Alternative 6 is the only action alternative that does not include water control structures on Pond 4/5. All action alternatives include the installation of water control structures on Ponds 7, 7A, and 8, and mixing of discharges from the ~~u~~Upper ~~p~~Ponds in a mixing chamber; all action alternatives would discharge from the mixing chamber to Napa Slough

Table 17-2. Comparison of Project Features and Outcomes

Project Features	No-Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Ponds Opened to Full Tidal Action	None	3, 4, and 5	3, 4, and 5	3, 4, 5, 6, 6A, and 2E	3 and 4	3, 4, and 5	3, 4, and 5	3, 4, and 5	3, 4, and 5
Acreage of Ponds Opened to Full Tidal Action	None	2,904	2,904	4,373	2,162	2,904	2,904	2,904	2,904
Ponds Retained as Ponds	1, 1A, 2, 3, 4, 5, 6, 6A, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8	1, 1A, 2W, 7, 7A, and 8	1, 1A, 2, 5, 6, 6A, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8	1, 1A, 2, 7, 7A, and 8
Acreage of Ponds Retained as Ponds	6,457	2,407	2,407	2,080	4,295	2,407	2,407	2,407	2,407
Adaptive Management of Ponds 6/6A	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Initial Levee Repairs (lineal feet)	None	46,460	46,460	24,130	47,670	46,460	46,460	46,460	46,460
New Water Control Structures at Pond 3	No	Yes	No	No	No	No	No	No	No
New Water Control Structures at Ponds 4/5	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
New Water Control Structures at Ponds 6/6A	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
New Siphon from Ponds 6/6A to Pond 2	No	No	No	No	No	No	No	Yes	No
New Water Control Structures and Mixing Chamber for Upper Ponds (Ponds 7, 7A, and 8)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Discharge from Upper Ponds to Napa Slough	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Discharge from Upper Ponds through Ponds 6/6A, 2, and 1/1A to San Pablo Bay	No	No	No	No	No	No	No	Yes	No
Use of Recycled Water	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Breaches for Habitat Restoration (number)	None	23	23	31	19	23	23	23	23
Ditch Blocks for Habitat Restoration (number)	None	22	22	26	16	22	22	22	22
Levee Lowering (lineal feet)	None	22,200	22,200	34,600	14,600	22,200	22,200	22,200	22,200
Starter Channels with Berms (lineal feet)	None	27,500	27,500	40,600	19,600	55,300	27,500	55,300	27,500
100-Acre Fill	No	No	No	No	No	Yes	No	Yes	No
Ongoing Levee Repairs	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Quality Monitoring	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Biological and Hydrological Monitoring	None	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Replacement of Water Control Structures	Minimal	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.	At Ponds 1, 1A, 2W, 7, 7A, and 8	At Ponds 1, 1A, 2, 5, 6, 6A, 7, 7A, and 8	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.	At Ponds 1, 1A, 2, 7, 7A, and 8. Also possibly 6/6A.

Table 17-2. Continued

Project Features	No-Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Salinity Reduction Duration (approx. years)									
Pond 3	1	1-2 years	<1 month	<1 month	<1 month	<1 month	<~~1 month~~ 3 months	<1 month	<1 month
Pond 4/5	NA	3-5[a]	2-3	2-3	2-3	2-3	<1 month	2-3	2-3
Pond 6/6A	NA	1	1	1	1	1	1	1	1
Pond 7	NA	<10~~30-50~~[b]	<10~~30-50~~[b]	≤10~~30-50~~[b]	≤10~~30-50~~[b]	≤10~~30-50~~[b]	≤10~~30-50~~[b]	<10[bd]	≤10~~≤50+(?)~~
Pond 7A	NA	1	1	1	1	1	1	1	1
Pond 8	1	1	1	1	1	1	1	1	1
Habitat Types at Year 50 (approx. acres)									
Subtidal	Unknown	770	770	930	680	770	770	770	770
Intertidal mudflat		1,620	1,620	2,800	930	900	1,620	900	1,620
Lower marsh		90	90	230	80	640	90	640	90
Middle marsh		2,190	2,190	2,180	2,220	2,360	2,190	2,360	2,190
Managed ponds		3,550[c]	3,550[c]	2,080	4,290	3,550[c]	3,550[c]	3,550[c]	3,550[c]

[a] Includes 1-2 years salinity reduction for Pond 3.

[b] Based on a bittern dilution ratio of 1:100 with a mass based discharge requirement.

[c] If Ponds 6 and 6A are also restored to tidal marsh after 10–20 years, the total acreage of managed ponds at year 50 would be 2,404.

[d] Expected to be twice as fast.

except Alternative 7, which would discharge to San Pablo Bay. Alternatives 1–6 and 8 also include ~~desalination~~ salinity reduction of Ponds 6/6A by means of water control structures into Pond 5 and from there into the Napa River. Alternative 7 instead would discharge water from the ~~u~~Upper ~~p~~Ponds through Ponds 6/6A, 2, and 1/1A into San Pablo Bay. Alternatives 1–6 and 8 would avoid any discharges through Ponds 1, 1A, and 2. Alternative 7 would use these ponds as additional dilution/mixing chambers for water discharged from the ~~u~~Upper ~~p~~Ponds and require the installation of an additional 63-inch-diameter culvert under SR 37. All action alternatives include monitoring of the discharge, fish screens on intakes from Napa Slough ~~or the Napa River~~ if needed, and diffusers on outfalls to the Napa River and Napa Slough. All action alternatives except Alternative 8 include the use of recycled water.

All action alternatives also have common habitat restoration elements. All action alternatives include breaches, starter channels and berms, and levee lowering at Ponds 3 and 4. All action alternatives except Alternative 4 also include these habitat restoration features at Pond 5. Alternative 3 additionally includes these habitat restoration features at Ponds 2E and 6/6A. The extent of levee lowering would be greatest under Alternative 3, and the extent of starter channels and berms would be greatest under Alternatives 5 and 7. In addition, these two alternatives include an approximately 100-acre fill to compensate for the potential fringing marsh loss when ponds are first opened to tidal action.

All alternatives incorporate adaptive management of the project area. Specifically, ponds would be opened to tidal action in a manner that allows orderly development of habitat to occur. Under Alternatives 1 and 2 and 5–8, Ponds 6 and 6A also become a major focus of adaptive management. The two ponds would be retained as ponds for the first 10–20 years of the project, and then, depending on a variety of factors, could be converted to tidal habitat or maintained as ponds in the long term.

All action alternatives also include installation of replacement water control structures at the start of the project for Ponds 1, 1A, and 2, and as needed during the life of the project for the ponds retained as ponds. Levee maintenance of all ponds retained as ponds would occur on a regular schedule. Only limited levee repair and repair or replacement of water control structures would occur under the No-Project Alternative.

17.3.1.2 Environmental Effects

The environmental analysis indicates that the construction and operation of the alternatives could result in significant adverse impacts on hydrology, water quality, vegetation, wildlife, aquatic resources, geology and soils, hazardous materials, transportation and circulation, air quality, noise, and cultural resources (Table 17-3). These impacts would occur under all alternatives, mostly during the construction/salinity reduction phase of the project. Nearly all impacts would be reduced to a less-than-significant level as a result of mitigation.

Each alternative would also result in beneficial impacts on flooding, water quality, wildlife, and aquatic resources. Table 17-4 provides a summary of

beneficial impacts. Generally, these beneficial impacts vary as a result of the different acreage of habitat types that would eventually occur under each alternative.

Although the alternatives share common impacts, the duration and intensity of these impacts help distinguish the alternatives from one another. Table 17-2 provides information that helps describe the duration and intensity of impacts. The following discussion of impacts on water quality, wildlife, aquatic resources, air quality and noise, and cultural resources summarizes the relative difference in intensity and duration of impacts between alternatives.

Water Quality

The duration of adverse impacts on water quality associated with salinity reduction would be similar under Alternatives 1, 2, 3, 4, and 5 because the period necessary to meet salinity reduction targets in Ponds 3, 4/5, and 7 would be nearly the same. The duration of water quality impacts would be greatest under Alternative 8 because it would take approximately 2 years longer ~~of the relatively long period necessary~~ to reduce the salinity in Pond 7. Conversely, the duration of adverse impacts on water quality would be shortest under Alternatives 6 and 7 because of the short period necessary to improve water quality in the lower ponds and meet water quality objectives in Pond 7.

Construction activities necessary to lower and breach levees would also adversely affect water quality. The intensity of water quality impacts would be greatest under Alternative 3 because nearly 35,000 ~~15,000~~ linear feet of levee would be lowered (Table 17-2). This would be followed by Alternatives 1, 2, 5, 6, 7, and 8, each of which includes approximately 22,000 ~~10,900~~ linear feet of lowered levees. Alternative 4 would have the least levee lowering (approximately 15,000 linear feet). Impacts on water quality associated with habitat restoration levee breaches would be nearly the same for Alternatives 1, 2, 5, 6, 7, and 8 because they include the same number of breaches. Impacts would be slightly less under Alternative 4 because it requires the fewest number of habitat restoration levee breaches, and slightly more under Alternative 3 because there are several more breaches than under the other alternatives.

Wildlife

Construction related impacts on wildlife and wildlife habitat would occur as a result of lowering levees, constructing water control structures, and breaching levees. Similar to impacts associated with water quality, the intensity and extent of impacts on wildlife associated with construction would be greatest under Alternative 3 because it requires the greatest amount of land-disturbing activity (Table 17-2). Impacts on wildlife associated with constructing Alternatives 1, 2, 5, 6, and 7 would be less than those under Alternative 3 because less land-disturbing activity would occur. Although impacts on wildlife associated with disturbing land at the ponds would be the same for Alternatives 1, 2, 5, 6, 7, and

Table 17-3. Summary of Significant Environmental Effects and Mitigation Measures

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Hydrology				
H-2: Modification of Surface Drainage Patterns	S	Measure H-2 (Avoid Drainage Pattern Alteration in Plans for Future Pipeline Alignments)	LTS	1, 2, 3, 4, 5, 6, 7
H-3: Increased Risk of Property Damage, Injury, or Death as a Result of Flooding	S	Measure H-1 (Repair Unintended Levee Breaches)	LTS	1,2, 3, 4, 5, 6, 7, 8
H-7: Potential Increase in Flood Risk on Adjacent Properties as a Result of Increased Discharge in Tidal Channels	S	Measure H-3 (Refine Project Design to Limit Adverse Effects of Increased Tidal Discharge)	LTS	1, 2, 3, 4, 5, 6, 7, 8
H-8: Potential Increase in Flood Risk on Adjacent Properties as a Result of Wave Erosion	S	Measure H-4 (Evaluate Susceptibility of Levees to Wind-Driven Wave Erosion and Conduct Repairs as Needed)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Water Quality				
WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water	S	None required for No-Project Alternative	NA	No-Project
WQ-2: Short-Term Construction-Related Water Quality Impacts	S	Measure WQ-1 (Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-5 (Prepare Levees and Time Breaches)	LTS ~~S~~	1, 2, 3, 4, 5, 6, 7, 8 ~~3, 5~~
		Measure WQ-6 (Prepare and Implement Storm Water Pollution Prevention Plans)	LTS	1, 2, 3, 4, 5, 6, 7
WQ-3: Increase in Salinity in the Napa River	S	Measure WQ-2 (Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-5 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
WQ-4: Increase in Conventional and Toxic Constituents	S	Measure WQ-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Water Quality (continued)				
WQ-5: Discharges of Priority Toxic Constituents in the Napa River and Local Sloughs	S	Measure WQ-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
WQ-6: Increase in Contribution of Conventional and Toxic Constituents from Recycled Water	S	Measure WQ-3 (Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements)	LTS	1, 2, 3, 4, 5, 6, 7
WQ-7: Water Quality Changes in the Salt Ponds	S	Measure WQ-4 (Monitor Pond Water Quality and Use Adaptive Management)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Vegetation				
V-2: Temporary Alteration of Common Vegetation and Sensitive Communities	S	Measure V-2 (Conduct Preconstruction Surveys and Implement Impact Avoidance, Minimization, and Mitigation Measures)	LTS	1, 2, 3, 4, 5, 6, 7
V-3: Removal of Soft Bird's-Beak	S	Measure V-1 (Avoid Ground Disturbance in Populations of Soft Bird's-Beak)	LTS	1, 2, 3, 4, 5, 6, 7, 8
V-7: Invasion of Nonnative Species	S	Measure V-3 (Monitor and Manage Invasive Exotic Plant Species)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Wildlife				
W-1: Long-Term Decline in Habitat Value and Function	S	None required for No-Project Alternative	NA	No-Project
W-2: Temporary Disturbance of Wildlife	S	None required for No-Project Alternative	NA	No-Project
W-3: Construction-Related Disturbance and Mortality of Special-Status Species	S	Measure W-1 (Avoid Construction Activities near Nesting Habitats during Breeding Season)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-4 (Complete Focused Surveys for Special-Status Wildlife Species before Construction)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-5 (Educate Construction Crews regarding Special-Status Wildlife Species)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-6 (Use Trenchless Construction Techniques for Special-Status Wildlife Species Protection)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure W-7 (Restore Habitat Modified by Construction)	LTS	1, 2, 3, 4, 5, 6, 7

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Biological Resources—Wildlife (continued)				
W-4: Construction-Related Disturbance and Mortality of Salt Marsh Harvest Mouse and Suisun Ornate Shrew	S	Measure W-2 (Avoid Construction Activities near Occupied Suisun Ornate Shrew Habitat or Remove Shrews)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure W-3 (Avoid Construction Activities near Occupied Salt Marsh Harvest Mouse Habitat)	LTS	1, 2, 3, 4, 5, 6, 7, 8
W-5: Exposure of Wildlife to Contaminants during Construction	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
W-6: Interference with the Movement of Wildlife	S	Measure W-4 (Complete Wildlife Surveys before Construction)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Aquatic Resources				
A-1: Reduced Water Quality as a Result of Uncontrolled Breaches of Levees	S	None required for No-Project Alternative	S	No-Project
A-4: Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs	S	None required for No-Project Alternative	S	No-Project
A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds	S	None required for No-Project Alternative	S	No-Project
		Measure A-1 (Minimize Entrainment of Sensitive Species)	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure A-2 (Install Cofferdams to Minimize In-Water Construction)	LTS	1, 7
		Measure A-4 (Use Trenchless Technology during Construction to Protect Aquatic Species)	LTS	1, 2, 3, 4, 5, 6, 7
A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality	S	Measure WQ-2 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-3 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure WQ-4 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure A-3 (Assess and Maintain Salinity Levels Protective of Aquatic Resources)	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-9: Substantial Interference with the Movement or Migration of Fish Species	S	Measure A-4 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
A-11: Short-Term Construction-Related Impacts	S	Measure WQ-1 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Geology and Soils				
Geo-1: Levee Failure as a Result of Strong Seismic Ground Shaking	S	None required for No-Project Alternative	S	No-Project
Geo-2: Levee Failure as a Result of Erosion	S	None required for No-Project Alternative	S	No-Project
Geo-4: Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse as a Result of Construction on Unstable Soils	S	Measure Geo-3 (Remove Unstable or Expansive Soils and Backfill with Engineered Fill)	LTS	1, 2, 3, 4, 5, 6, 7
Geo-5: Risk to Life or Property as a Result of Construction of Structures on Expansive Soils	S	Measure Geo-3 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7
Geo-7: Potential Erosion as a Result of Excess Pond Water Height	S	Measure Geo-2 (Maintain Water Level 2 Feet below Levee Crest)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Geo-8: Potential Erosion as a Result of Increased Tidal Prism	S	Measures H-1, H-3, and H-4 *(see "Hydrology" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Hazards and Hazardous Materials				
Haz-1: Potential Release of Bittern or Highly Saline Brines into the Environment as a Result of Levee Breaching	S	None required for No-Project Alternative	S	No-Project
Haz-2: Potential Exposure to and/or Release of Hazardous Materials/Waste Associated with Construction Activities	S	Measure Haz-1 (Provide Enhanced Spill Prevention and Response Training, and Spill Response Preparation)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-4: Potential Releases of Residual Hazardous Materials or Constituents from Breaching of Levees	S	Measure Haz-2 (Employ Explosives Experts when Breaching Levees)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-5: Potential Releases of Irritant Dust as a Result of Construction Activities	S	Measure Haz-3 (Develop and Implement a Health and Safety Plan)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-4 (Monitor Perimeter Dust Concentrations during Work on and in the Vicinity of Pond 8)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Haz-9: Exposures Resulting from Exceeding Human Health Criteria	S	Measure Haz-5 (Prepare and Implement a Safety Plan)	LTS	1, 2, 3, 4, 5, 6, 7
Transportation and Circulation				
T-3: Increase in Construction-Related Traffic Hazards	S	Measure T-1 (Implement Safety Plan for Pipeline Construction along Rail Line)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure T-2 (Implement Safety Plan for Construction along Public Roads)	LTS	1, 2, 3, 4, 5, 6, 7

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Air Quality				
AQ-3: Potential Releases of Irritant Dust as a Result of Construction Activities	S	Measure AQ-1 (Minimize Dust Generation and Implement Dust Control Measures for Work Areas with Salt Crusts)	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-3 *(see "Hazards and Hazardous Materials" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Haz-4 *(see "Hazards and Hazardous Materials" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Noise				
N-1: Temporary Increase in Ambient Noise Levels as a Result of Emergency Repairs	SU	None required for No-Project Alternative	SU	No-Project
N-2: Temporary Increase in Ambient Noise Levels as a Result of Construction	SU	Measure N-1 (Decrease Noise Levels with Use of Noise Reduction Devices)	SU	1, 2, 3, 4, 5, 6, 7
Land Use and Planning				
LU-1: Compatibility with Land Use Goals and Objectives	S	Measure N-1 *(see "Noise" above)*	LTS	1, 2, 3, 4, 5, 6, 7
Public Services and Utilities				
PS-2: Increased Risk of Instability of Power Towers	S	Measure PS-1 (Ensure the Stability of the Power Towers)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Recreation, Public Access, Visual Resources, and Public Health				
R-6: Increased Mosquito Production	S	Measure R-1 (Coordinate Project Activities with the Napa County Mosquito Abatement District)	LTS	1, 2, 3, 4, 5, 6, 7, 8
R-7: Short-Term Conflicts with Existing or Planned Recreational Uses, and Recreation Plans and Policies	S	Measure R-2 (Prepare a Public Access Plan)	LTS	1, 2, 3, 4, 5, 6, 7
Cultural Resources				
C-2: Potential for Ground-Disturbing Activities to Damage Previously Unidentified Buried Cultural Resources Sites	S	Measure C-1 (Stop Work If Cultural Resources Are Discovered during Ground-Disturbing Activities)	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-3. Continued

Resource/Effect	LOS Before Mitigation *	Mitigation	LOS After Mitigation *	Applicable Alternatives
Cultural Resources (continued)				
C-3: Potential to Damage Previously Unidentified Human Remains	S	Measure C-2 (Comply with State Laws Pertaining to the Discovery of Human Remains)	LTS	1, 2, 3, 4, 5, 6, 7, 8
C-4: Changes in the Significance of a Historic and/or Archaeological Resource	S	Measure C-3 (Conduct Archaeological Monitoring of Construction Activities in the Vicinity of CA-NAP-224, C-164, and CA-NAP-230)	LTS	1, 2, 3, 4, 5, 6, 7
		Measure C-4 (Conduct Records Search and Visual Survey)	LTS	1, 2, 3, 4, 5, 6, 7
C-5: Disturbance of Human Remains	S	Measure C-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7
Cumulative Impacts				
Cu-1: Cumulative Hydrologic Changes in the Lower Napa River	S	Measure Cu-1 (Implement Monitoring and Adaptive Management Program)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-2: Cumulative Adverse Change in Water Quality	S	Measure WQ-2 *(see "Water Quality" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
		Measure Cu-1 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-4: Increase in Nonnative Smooth Cord Grass	S	Measure V-3 *(see "Biological Resources—Vegetation" above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-5: Cumulative Reduction in Sensitive Vegetation Species and their Habitats	S	Measure Cu-2 (Conduct Biological Surveys for Sensitive Biological Resources)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-7: Loss of Open-Water Habitat for Migratory Shorebirds and Waterfowl	LTS	None required	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-8: Exposure of Wildlife to Contaminants in Sediments and Waters from San Pablo Bay and the Napa River	S	Measure Cu-3 (Contribute to Regional Research Efforts on the Exposure of Wildlife to Contaminants)	LTS	1, 2, 3, 4, 5, 6, 7, 8
Cu-9~~8~~: Cumulative Reduction in Sensitive Wildlife Species and their Habitats	S	Measure Cu-2 *(see above)*	LTS	1, 2, 3, 4, 5, 6, 7, 8

* LOS = Level of Significance; LTS = Less than Significant; S = Significant; SR = salinity reduction component of alternative; SU = Significant and Unavoidable.

Table 17-4. Summary of Beneficial Impacts

Resource/Effect	Applicable Alternatives
Hydrology	
H-1: Reduced Risk of Property Damage, Injury, or Death as a Result of Flooding	1, 2, 3, 4, 5, 6, 7, 8
H-5: Increased Flood Conveyance Capacity	1, 2, 3, 4, 5, 6, 7, 8
Water Quality	
W-8: Long-Term Changes to Water Quality in Local Rivers and Salt Ponds from Project Operations	1, 2, 3, 4, 5, 6, 7
Biological Resources—Vegetation	
V-5: Long-Term Enhancement of Common Vegetation and Sensitive Communities	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Wildlife	
W-7: Increase in Mudflat Foraging Habitat	1, 2, 3, 4, 5, 6, 7, 8
W-8: Long-Term Increase in Subtidal Habitat	1, 2, 3, 4, 5, 6, 7, 8
W-9: Increase in Lower Marsh and Middle Marsh Habitats	1, 2, 3, 4, 5, 6, 7, 8
W-10: Lowering of Levees to Create Marsh Habitat	1, 2, 3, 4, 5, 6, 7, 8
Biological Resources—Aquatic Resources	
A-10: Substantial Increase in Habitat Area and Types	1, 2, 3, 4, 5, 6, 7, 8
Geology and Soils; Hazards and Hazardous Materials; Transportation and Circulation; Air Quality; Noise; Land Use and Planning; Public Services and Utilities	
No beneficial impacts for these resource areas.	
Recreation, Public Access, Visual Resources, and Public Health	
R-1: Enhanced Recreational Opportunities	1, 2, 3, 4, 5, 6, 7, 8
Cultural Resources	
No beneficial impacts for this resource area.	
Cumulative Impacts	
Cu-3: Cumulative Change in Sensitive Plant Communities	1, 2, 3, 4, 5, 6, 7, 8
Cu-6: Long-Term Increase in Lower and Middle Marsh Habitat Suitable for Special-Status Species	1, 2, 3, 4, 5, 6, 7, 8
Cu-10: Increase in Subtidal Habitat	1, 2, 3, 4, 5, 6, 7, 8

8, short-term construction related impacts on wildlife would be less under Alternative 4 because there is less levee lowering and Alternative 8 because the pipelines proposed for importing treated wastewater would not be constructed.

Wildlife would benefit from restoration of the salt ponds that would occur under Alternatives 1–8. The extent of this benefit is a function of the types of habitat that would be created, which includes subtidal, intertidal mudflat, lower marsh, middle marsh, and managed ponds. The acreage of these beneficial habitat types varies among the different alternatives (Table 17-2).

Aquatic Resources

Most impacts on aquatic resources would occur under the construction and salinity reduction phase of each alternative. The extent of impacts on aquatic resources during the salinity reduction phase are expected to be less under Alternatives 4 and 6 than under other alternatives because under Alternative 4 fewer ponds would be opened to tidal action, and under Alternative 6 salinity reduction of the lower ponds would occur relatively quickly reducing the potential for adverse effects to aquatic resources. Impacts are expected to be slightly greater under Alternatives ~~1, 2,~~ 3, 5, and 7 ~~and 8~~ because these alternatives would result in the greatest number of ponds being reopened to tidal action and have the most extensive starter channels and berms. Opening these ponds would result in short-term adverse impacts on aquatic resources as a result of decreased water quality, and increased potential of entrainment and stranding. Recycled water would be sent to the Napa River, North Slough, Hudeman Slough, or other existing discharge locations and would not adversely or beneficially affect aquatic resources.

Similar to wildlife, aquatic resources would benefit as a result of the restoration that would occur under Alternatives 1–8. This benefit would vary among alternatives based on the mix of habitat types that are restored and the number of ponds that are open to tidal exchange (Table 17-2).

Air Quality and Noise

The extent of air quality and noise impacts is directly related to the amount of ground-disturbing activities that would be required under each alternative. Impacts would be greatest under Alternative 3 because it includes the greatest amount of ground~~land~~-disturbing activities when starter channel construction, levee lowering, breaches, and pipeline construction are combined (Table 17-2). Air quality and noise impacts would be less under Alternatives 1, 2, 4, 5, 6, and 7 than under Alternative 3 because less land-disturbing activity would occur. Impacts on air quality and noise would be less under Alternative 8 than under all other alternatives because the pipelines proposed for importing treated wastewater would not be constructed.

Cultural Resources

Impacts on cultural resources generally would be limited to the construction phase of the project, although some effects could occur during habitat restoration as sloughs erode. The potential to affect cultural resources is higher for those alternatives that include the greatest amount of land-disturbing activity, such as levee lowering, construction of water control structures, and breaching levees. Impacts on cultural resources would be greatest under Alternatives 3 and ~~5~~ 7 because these alternatives require the greatest amount of land-disturbing activity (Table 17-2). Potential impacts on cultural resources would be less under Alternatives 1, 2, 4, 5, 6, and 8~~7~~ because less land-disturbing activity would occur. ~~Although the potential for impacts on cultural resources would be the nearly the same for Alternatives 1, 2, 6, 7, and 8, p~~Potential impacts are expected to be less under Alternative 8 because the pipelines proposed for importing treated wastewater would not be constructed.

17.3.2 Additive Impacts

By combining the salinity reduction, water delivery, and habitat restoration options, there is potential for additive impacts, or new impacts that could result from combining project options.

While the timing of combinations of construction and operation activities would differ for each alternative, the location, intensity, and duration of these activities were described in the impact analysis for the salinity reduction, water delivery, and habitat restoration options. There would not be any additive short-term construction- or long-term operation-related impacts for any of the resource topics that are not already addressed in the ~~EIR/~~EIS.

17.4 Alternative Selection

17.4.1 Environmentally Superior Alternative

The environmentally superior alternative is the alternative that would result in the least damage to the biological and physical environment, and that protects, preserves, and enhances the historical, cultural, and natural resources of the project area. As this is a restoration project, all alternatives by definition would benefit the biological and physical environment and are designed to enhance the natural resources in the project area. However, Alternative 6 ~~(Draft Feasibility Report Alternative 10)~~ is considered the environmentally superior alternative because it would result in relatively quick salinity reduction of the lower ponds (several weeks for Pond 3 and several months for Pond 4/5), reducing the potential for adverse effects to aquatic resources. Construction-related ground disturbance associated with this alternative is equivalent to Alternatives 1, 2, 5, and 7, ~~and 8,~~ and less than Alternative 3. While there would be more construction-related ground disturbance than under Alternatives 4 and 8,

Alternative 4 does not result in the optimal mix of restored habitats and Alternative 8 does not provide beneficial use of recycled water. The short period of time for salinity reduction helps the habitat restoration process proceed sooner under Alternative 6 than all others except Alternatives 5 and 7 (which requires the use of fill). Alternative 6 ~~(Draft Feasibility Report Alternative 10)~~ provides a mixture of pond and tidal marsh habitats that meets the project objectives and is phased in a way that would minimize current and future adverse effects. Though some effects are less with Alternative 8, these effects can be mitigated and the recycled water is needed to accelerates the salinity reduction process of the Upper Ponds and may assist in long-term management of the NSMWA~~upper ponds~~.

The No-Project Alternative is not considered the environmentally superior alternative because of the continued deterioration of the site and potential for long-term adverse water quality effects.

17.4.2 Proposed Project/Action

Based on the latest modeling, observation of the salinity reduction of Pond 3, and discussions with the San Francisco Bay RWQCB, DFG and the Coastal Conservancy are selecting Alternative 6 as the proposed project. The Corps is currently working with DFG and the Coastal Conservancy to determine which portions of the project will be subject to federal civil works construction, and which portions of the project will be permitted by its regulatory branch and constructed by DFG. The specific components of the proposed action will be described in detail in the Record of Decision. ~~The project sponsors will select either Alternative 2 (Draft Feasibility Report Alternative 6) or Alternative 6 (Draft Feasibility Report Alternative 10) as the proposed project. These two alternatives are nearly identical except for their treatment of Ponds 4 and 5 during salinity reduction. Alternative 2 (Draft Feasibility Report Alternative 6) uses water control structure to reduce salinities in Ponds 4 and 5, while Alternative 6 (Draft Feasibility Report Alternative 10) uses levee breaches to reduce salinity. The project sponsors are working with the RWQCB to select the proposed project. The proposed project will be identified in the Final EIR. The Draft Feasibility Report identifies Alternative 6 (Draft EIR/EISAlternative 2) as the recommended plan.~~

Chapter 18
Cumulative Impacts and Other Required Analyses

18.1 Introduction

NEPA and CEQA require the analysis of cumulative impacts, irreversible and irretrievable commitments of resources, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term environmental productivity, and growth-inducing effects.

18.2 Cumulative Impacts

Cumulative impacts are effects that produce a change in the environment that results from the incremental effect of a project when added to other closely related past, present, or reasonably foreseeable, probable future projects.

CEQ regulations and the State CEQA Guidelines require that cumulative impacts of a proposed project be addressed when the cumulative impacts are expected to be significant (40 CFR 1508.25[a][2], 14 CCR 1530[a]).

18.2.1 Methodology and Significance Criteria

The project-specific effects of the options were evaluated to assess the potential cumulative effects. Only those effects that were identified as permanent effects and that have the potential to be additive to the effects of other projects in the region are analyzed. The analysis focuses on the following resource categories:

- hydrology,
- water quality,
- biological resources—vegetation,
- biological resources—wildlife, and
- biological resources—aquatic resources.

Effects on the following resource categories were found not to have the potential to contribute to cumulative impacts because the effects were extremely minor, were temporary, or had no potential to be additive and therefore contribute to cumulative impacts:

- geology and soils;
- hazards and hazardous materials;
- transportation and circulation;
- air quality;
- noise;
- land usc and planning;
- public services and utilities;
- recreation, public access, visual resources, and public health; and
- cultural resources.

The methodology used to analyze the cumulative impacts associated with the key resource topics included

- developing a list of past, present, and reasonably foreseeable future projects in the vicinity of the project area;
- reviewing concerns recently expressed by a scientific panel about the cumulative impacts of baywide restoration and mitigation efforts;
- reviewing the general plans of local counties; and
- qualitatively evaluating the cumulative impacts of past, present, and future projects.

The project would have a significant cumulative impact if it, in conjunction with other projects, would exceed the significance criteria established for a resource topic.

18.2.2 Projects Addressed in the Cumulative Impact Analysis

18.2.2.1 Salinity Reduction and Habitat Restoration Options

Projects considered during the cumulative impact analysis are listed in Table 18-1.

Table 18-1. Ongoing and Reasonably Foreseeable Projects in the Vicinity of the Project

Ongoing	Reasonably Foreseeable Projects
American Canyon Treatment Plant	Bel Marin Keys Restoration Project
Carl's Marsh Restoration Project	Cullinan Ranch Restoration Project
Greenpoint Restoration Project	Fagan Slough Restoration Project
Guadalcanal Village Wetland Mitigation Project	Hamilton Restoration Project
Inner Muzzi Restoration Project	
Mare Island Dredge Ponds Restoration/Recreation	Skaggs Island Restoration Project
Napa River Channel Dredging	Napa Crystallizer Ponds Restoration Project
North Slough Marsh Restoration Project	
Novato Sanitation District Plant Improvements	
Outer Muzzi Restoration Project	
Pond 2A Restoration Project	
Slaughterhouse Slough Restoration Project	
Sonoma Baylands Restoration Project	
Sonoma County Water Agency Storage Reservoir	
Tolay Creek Restoration Project	
Vallejo Highway 37 Widening Project	
Vallejo Marina/Yacht Club Dredging Lease	
Vallejo River Park Master Plan	
White Slough Flood Control Project	
White Slough Restoration Project	

The Napa River Salt Marsh Restoration Project would result in a substantial long-term benefit to endangered species and aquatic resources by creating a substantial amount of new subtidal habitat and eventually marsh habitat. However, there is the potential for several significant cumulative impacts associated with the project. The following sections provide a topical analysis of cumulative project effects.

18.2.2.2 Water Delivery Option

Cumulative impacts associated with the Water Delivery Option are addressed first by evaluating potential combined effects of implementing the Project and Program Components, and then by evaluating impacts associated with other water and wastewater infrastructure improvement projects anticipated to occur in the north bay region.

Water Delivery Project and Program Components

As described in detail in Chapter 2, "Site Description, Options, and Alternatives," the Project Component includes the Sonoma, CAC, and Napa Pipelines, and the Program Component includes the American Canyon, Novato, Petaluma, and Las Gallinas Pipelines.

Other Water/Wastewater Infrastructure Projects

Table 18-2 is an overview of the other infrastructure improvement projects anticipated to occur within the north bay region based on information received from the responsible district or city.

Table 18-2. Other Infrastructure Improvement Projects Anticipated to Occur within the North Bay Region

District or City	Project
Sonoma Valley County Sanitary District	Upgrade the existing plant from secondary to tertiary treatment (next several years~~summer 2004~~).
Novato Sanitation District	Upgrade the Ignacio plant to improve secondary treatment capabilities or combine the Ignacio plant with the Novato plant (scheduled to occur over the next 4–5 years).
	Provide an additional 1-mgd treatment capacity by 2020 (still in planning stages).
City of Petaluma	Implement a 3-phase project to provide recycled water for urban uses. Phase 1 (spring 2004) would bring recycled water from the city's existing agricultural recycled water system to Rooster Run Golf Course and two vineyards. Phase 2 (spring 2007) would connect a new Title 22 recycled water pump station to the Phase 1 pipeline in order to add more customers to the distribution system. Phase 3 (spring 2010) would complete the recycled water distribution system.

18.2.3 Cumulative Impact Analysis

18.2.3.1 Hydrology

Salinity Reduction and Habitat Restoration Options

Impact Cu-1: Cumulative Hydrologic Changes in the Lower Napa River

Implementation of the proposed project in conjunction with other projects would result in potential hydrologic effects on the lower Napa River. Preliminary project modeling, which included the proposed project and the Cullinan Ranch

Restoration Project, indicates that localized hydrologic changes would occur in the tidal sloughs and in the Napa River (Philip Williams and Associates 2002c). Implementation of the Skaggs Island Restoration Project would likely have similar effects, but those effects have not yet been quantified.

The above projects would cumulatively cause a substantial increase in the tidal prism and would likely cause rapid scour of the tidal sloughs and adjoining fringe marshes, resulting in sediment suspension and redistribution throughout the Napa River and into San Pablo Bay. This suspension and redistribution could result in beneficial effects, such as a reduction in the amount of dredging needed in the Napa River and the Vallejo marina. It could also result in adverse effects, such as a slowing of current restoration efforts along the lower Napa River.

Until the tidal sloughs are enlarged enough to convey the full tidal prism, the tidal range will be muted (Philip Williams Associates 2002c). Muted tides may slow the accretion of sediments in the restoration areas; slow the evolution of higher marsh habitats in the restoration areas; and modify the hydrologic regime of existing marshlands within the slough network, potentially causing a vegetation type shift. This vegetation type shift is not expected to be adverse because it represents the natural movement and evolution of habitats, and will be monitored through the adaptive management program designed for the project.

The increased tidal prism would also increase the maximum velocities through the Mare Island Strait and the lower Napa River. Although increased channel velocities may aid in long-term channel maintenance by reducing the need for dredging, the increased velocities may pose a hazard to maritime traffic. Model runs that include the proposed project and the Cullinan Ranch Restoration Project predict that channel velocities may increase by up to 1 meter per second (Philip Williams Associates 2002c). It should be noted that the increased tidal prism is only a partial restoration of the historical tidal prism.

Some uncertainty remains regarding the sediment redistribution effects of the project in the lower Napa River, and this redistribution has the potential to cause substantial adverse affects throughout the area; therefore, this impact is considered significant.

Implementation of Mitigation Measure Cu-1 would reduce this impact to a less-than-significant level.

Mitigation Measure Cu-1: Implement Monitoring and Adaptive Management Program. The project sponsors will prepare a program to monitor and evaluate natural resource changes throughout the project area and in the lower Napa River, and an adaptive management program to rectify, avoid, or minimize long-term adverse project effects. The monitoring program will identify and establish ongoing data collection stations throughout the Napa River Unit, including the lower Napa River. The project sponsors will monitor key project parameters including erosion, water quality, vegetation, wildlife, and fish. The results from this data collection effort will be shared with regional natural resource managers from USFWS, DFG, and the San Francisco Estuary Institute, who are evaluating habitat conditions as a whole. The project sponsors will set

performance criteria for each of these parameters; if the performance criteria are not achieved, the adaptive management program will take effect. The adaptive management program will identify supplemental management techniques to be implemented for each resource parameter.

Water Delivery Option

Implementation of the Water Delivery Option components and the other water and wastewater infrastructure improvements is not expected to substantially alter existing drainage patterns, substantially increase runoff, or increase the risk of substantial property loss, injury, or death as a result of flooding.

18.2.4 Water Quality

18.2.4.1 Salinity Reduction and Habitat Restoration Options

Impact Cu-2: Cumulative Adverse Change in Water Quality

The flushing of other conventional physical and chemical constituents from the salt ponds and other regional projects, including the use of recycled water, into the Napa River could temporarily degrade water quality in the lower Napa River and sloughs.

However, in the future, allowable numeric and narrative water quality objectives will most likely become more restrictive as water quality regulatory programs are implemented. For example, Phase II NPDES stormwater permit rules for municipal and industrial discharges begin to take effect in 2003. TMDL programs for 303(d) listed constituents in Bay Area waters and associated implementation plans will also be completed by the San Francisco Bay RWQCB in the next several years and the draft TMDL for mercury has just recently been prepared. The TMDL implementation plans will contain new restrictions on the allowable mass loading of contaminants from various discharge sources in the watersheds. The specific requirements of these programs and ramifications of the discharges affecting the lower Napa River and northern San Pablo Bay are currently speculative. However, in general these future regulatory programs should improve background water quality conditions and reduce exposure of the restored ponds to water quality impacts from other discharges of toxic and conventional constituents. In addition, background concentrations of the most toxic constituents, such as mercury, organochlorine pesticides, and PCBs are expected to decline gradually over time because their use has been either discontinued or greatly reduced.

Ongoing issues of concern from the point-source and nonpoint-source discharges include adverse changes in the concentrations of pH, temperature, TSS, DO,

oxygen-demanding substances [BOD], and biostimulatory nutrients (nitrogen and phosphorus). Resources that might be adversely affected include fish habitat and habitat for other marine and estuarine aquatic organisms. Some of the contaminants present in the ponds are potentially harmful to aquatic wildlife if the concentration and duration of exposure is sufficiently elevated above baseline conditions. BOD may increase and DO may be sufficiently suppressed to cause short-term impairment of habitat. Specific modeling of fate and transport characteristics of these constituents during salinity reduction operations has not been conducted. In general, the concentration differences of conventional constituents between the ponds and background receiving water are relatively low compared to the difference in salinity. Therefore, careful management of the salinity reduction operations should result in only small increases in receiving water concentrations of conventional constituents. In addition, cumulative restoration efforts for tidal wetland areas throughout the north bay have the potential to provide net environmental benefits. Wetlands are generally acknowledged to provide favorable water quality improvement mechanisms such as filtration, settling, photodegradation, adsorption, and enhanced biological activity (uptake, chemical transformation, degradation).

However, if project operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring" (see Chapter 4, "Water Quality"), and Mitigation Measure Cu-1, "Implement Monitoring and Adaptive Management Program" (see "Hydrology" above) would reduce this impact to a less-than-significant level.

18.2.4.2 Water Delivery Option

Construction activities associated with the Water Delivery Option components and the other water and wastewater infrastructure improvement projects pose the potential to substantially degrade surface water quality. ~~The most notable impacts would relate to erosion and sedimentation from surface runoff on exposed soils. Such impacts would be temporary and local in nature, but are considered cumulatively significant. Implementation of Mitigation Measure Cu-2 would reduce this impact to a less-than-significant level.~~

The use of recycled water for projects with net environmental benefits is considered an important component of the overall waste management strategy of San Francisco Bay RWQCB. Wetland enhancement projects using recycled water are specifically encouraged. The proposed project would eventually provide net environmental benefits in the form of less discharge of waste to the Napa River and San Pablo Bay, once salinity reduction is completed. At that time, the recycled water will be available for irrigated agricultural operations or other wetland enhancement projects, thus reducing discharges to receiving waters. However, construction could result in localized cumulative water quality effects as described below.

Impact Cu-2: Cumulative Adverse Change in Water Quality

Construction activities associated with the Water Delivery Option components and the other water and wastewater infrastructure improvement projects could substantially degrade surface water quality. The most notable impacts would result from erosion and sedimentation caused by surface runoff on exposed soils. Such impacts would be temporary and local in nature, but are considered cumulatively significant. Implementation of Mitigation Measure WQ-6 "Prepare and Implement Water Pollution Prevention Plans," would reduce this impact to a less-than-significant level. This mitigation is described in Chapter 4, "Water Quality."

18.2.5 Biological Resources—Vegetation

18.2.5.1 Salinity Reduction and Habitat Restoration Options

Beneficial Impact Cu-3: Cumulative Change in Sensitive Marsh Plant Communities

Implementation of the project would result in a long-term net increase in habitat suitable for sensitive communities and special-status plant species. Several other restoration projects in the vicinity may have similar long-term benefits. The timing, scope, type, and rate of restoration of this and other projects would vary, and it is considered unlikely that potential effects from multiple projects would coincide such that the viability of sensitive communities or any one special-status plant species is threatened in the region. The implementation of this and other projects is therefore expected to result in the long-term net increase in the availability, connectivity, and quality of habitats suitable for sensitive communities, and the population of special-status plant species. Project implementation would result in a cumulative net benefit to sensitive communities and special-status plant species. This impact is considered beneficial. No mitigation is required.

Impact Cu-4: Increase in Nonnative Smooth Cord Grass

Implementation of this and other tidal marsh restoration projects in the vicinity would increase the probability that nonnative plant species, especially smooth cord grass, would become established and adversely affect habitat restoration. Smooth cord grass and other nonnative invasive species are aggressive colonizers of open, unvegetated habitats typical of early tidal marsh restoration projects, and the number of restoration projects planned in the area increases the availability of suitable habitat for colonization. Several restoration projects along San Francisco Bay have been degraded because nonnative, smooth cord grass has outcompeted native California cord grass. One occurrence of smooth cord grass

was discovered in the project area and removed. The most intact remaining stand of native California cord grass is adjacent to the project site. Consequently, native California cord grass is expected to readily colonize the project area and other tidal marsh restoration projects in the vicinity. Nonetheless, this impact is considered significant. Mitigation Measure V-3, "Monitor and Manage Invasive Exotic Plant Species," would minimize or prevent the establishment of nonnative smooth cord grass in the project area and would reduce this impact to a less-than-significant level. This measure is described in Chapter 5, "Biological Resources—Vegetation."

18.2.5.2 Water Delivery Option

The most notable potential for cumulative impacts on biological resources would occur in conjunction with the Water Delivery Option components, -SVCSD's new reclaimed water storage reservoir, and possibly the City of Petaluma's recycled water improvements. The other projects would occur primarily as improvements at existing WWTPs.

Impact Cu-5: Cumulative Reduction in Sensitive Upland Vegetation Species and Their Habitats

As described in Chapter 5, "Biological Resources—Vegetation," construction of the pipelines under the Project and Program Components of the Water Delivery Option poses the potential for significant impacts on sensitive vegetation species. In addition, construction of SCWA's new reservoir would occur in an area near Schell Slough that could contribute to indirect impacts on sensitive biological resources. Completion of the City of Petaluma's recycled water distribution system could include construction of, or improvements to, pipelines located in proximity to sensitive biological resources.

The overall impacts associated with these projects are considered cumulatively significant. Implementation of Mitigation Measure Cu-~~3~~2 would reduce this impact to a less-than-significant level.

Mitigation Measure Cu-~~3~~2: Conduct Biological Surveys for Sensitive Biological Resources.

Before completion of final plans for design and construction of each project included in the cumulative impacts analysis, a biological survey(s) will be conducted as necessary to determine the presence or absence of sensitive biological resources in, or near, projects proposed by the SCWA or sanitation districts. The survey(s) should be conducted in a manner similar to that described in Chapters 5 and 6 for the currently proposed components of the Water Delivery Option (e.g., use a qualified biologist[s], survey during appropriate season). Additionally, provisions for impact avoidance, minimization, or mitigation similar to those described in Chapters 5 and 6 will be included in each project as appropriate, based on the findings of the biological survey(s) and coordination with affected resources agencies.

18.2.6 Biological Resources—Wildlife

18.2.6.1 Salinity Reduction and Habitat Restoration Options

Beneficial Impact Cu-6: Long-Term Increase in Lower and Middle Marsh Habitat Suitable for Special-Status Species

Restoration of the tidal marshes in the project area would result in a substantial long-term increase in lower marsh and middle marsh habitats. These habitats are suitable for endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh harvest mouse, Suisun shrew, northern harrier, saltmarsh common yellowthroat, and San Pablo song sparrow. Cumulatively, restoration efforts would result in greater habitat complexity, diversity, and productivity and contribute to the overall reestablishment of tidal marsh habitats throughout the bay. This impact is considered beneficial. No mitigation is required.

Impact Cu-7: Loss of Open-Water Habitat for Migratory Shorebirds and Waterfowl

A cumulative change in open water habitats in San Pablo Bay is expected over the next 20–50 years. This change could result in either an increase or decrease of open-water habitat, depending on which restoration/mitigation projects are implemented. For example, if the Cullinan Ranch and Skaggs Island restoration projects (several of the largest possible north bay restoration projects) are implemented, a net increase in open-water habitat would occur. However, if only the Cullinan Ranch project is implemented, there would be a net decrease in open-water habitat.

The ecological values and productivity of the open-water habitat being gained or lost must be considered. Studies being conducted by USGS are beginning to provide insight into these values within the NSMWA (Takekawa et al. 2000). Ponds 1 and 1A, which provide some of the best values to migratory shorebirds, would be unaffected by the project. Pond 2, a pond that has traditionally provided high values to some migratory waterfowl, would be made more sustainable with the improvement of water control structures and levees. Ponds 3, 4, and 5 provided high-quality waterfowl foraging and refuge habitat during salt production and several years ago, although these habitats appear to have declined in value in the last few years because of an inability to manage the ponds effectively. These ponds would be converted to successional tidal marsh that would initially provide foraging and refuge habitat but would become lower and middle marsh in the long term. Ponds 6, 6A, 7, 7A, and 8 would be improved for waterfowl and shorebird use as a result of the reduction in salinity, improved water management ability, and levee improvements.

Changes in open-water habitat are not expected to adversely affect migratory shorebirds and waterfowl because of the numerous foraging and refuge areas throughout San Pablo Bay. Migratory shorebirds and waterfowl would redistribute among available habitats, including White Slough, Slaughterhouse Slough, Carl's Marsh, Ponds 1 and 1A, other ponds within the project area, other restoration/mitigation sites like Cullinan Ranch, and nearshore waters of San Pablo Bay. Proposed monitoring by USGS would provide additional information on the habitat values and species composition changes in the NSMWA and could provide important direction for future adaptive management decisions. Therefore, this impact is considered less than significant. No mitigation is required.

Impact Cu-8: Exposure of Wildlife to Contaminants in Sediments and Waters from San Pablo Bay and the Napa River

Restoration of the tidal marshes in the project area would result in a substantial long-term increase in lower marsh and middle marsh habitats. Reestablishing tidal connectivity to these marsh areas would result in hydrologic exchange between restored marshlands and waters of San Pablo Bay and the Napa River, possibly resulting in the deposition of contaminant-~~laden~~ containing sediments. As discussed in Chapter 4, "Water Quality," reestablishing tidal exchange is expected to cause the quality of water and sediments within the ponds to become closer to the quality of water in San Pablo Bay and the Napa River. The levels of some constituents are expected to increase. Conversely, the levels of other constituents are expected to decrease. On a regional level, contaminants may have an adverse effect on biological resources, including reduction in reproductive success at multiple levels of the ecosystem, immune system effects, and overall reduced population viability. Appendix C, "Contaminants Toxic to Wildlife," includes information on the contaminants and associated biological effects.

Contaminants are found in the waters and sediments throughout the San Pablo Bay, the Napa River, and adjacent areas. As indicated in Tables 4-5 and 4-6, some of these contaminants exceed sediment quality criteria established by NOAA and the water quality criteria established by the SWRCB (CTR). For example, the waters of the Napa River and San Pablo Bay exceed CTR water quality criteria for copper, mercury, nickel and total PAHs. In addition, sediments exceed the ER-L values for copper, mercury, nickel, arsenic, chromium, and DDT, but not the ER-M values for any constituent. The level these constituents would need to reach in combination with the duration of exposure to result in a substantial effect on wildlife abundance is not known. Similarly, the possible accumulation of bioavailable mercury is not known. Cumulatively, over the long-term, changing contaminant levels could result in regional adverse effects on wildlife. Therefore, this impact is considered significant. Implementation of Mitigation Measure Cu-43, "Contribute to Regional Research Efforts on the Exposure of Wildlife to Contaminants," would reduce this impact to a less-than-significant level.

Mitigation Measure Cu-43: Contribute to Regional Research Efforts on the Exposure of Wildlife to Contaminants

As discussed in Section 2.7.3.2, "Wildlife Monitoring in Managed Ponds and Restored Tidal Habitat," USGS would continue to monitor conditions at the project site. At a minimum, monitoring would occur during the salinity reduction phase of the project and for 10 years after each pond is breached. This information would be used to compare preproject and postproject conditions and to identify changes in the condition of biological resources. In addition, as discussed in Section 2.7.4, "Adaptive Management," the project sponsors would implement an adaptive management plan. This plan would establish quantitative standards for the project. The combination of wildlife monitoring and adaptive management would ensure that adverse effects on wildlife are identified and addressed as the tidal marsh is restored.

In the event these monitoring efforts provide data that suggests a regional problem, the project sponsors would contribute their proportional share to the following types of additional mitigation:

- regional ecological risk assessment;
- additional research efforts on contaminants effects on wildlife and methods for minimizing toxic pathways; and
- alternative management methods for restoration areas that demonstrate approaches to reduce susceptibility to chronic bioaccumulation.

18.2.6.2 Water Delivery Option

Impact Cu-9: Cumulative Reduction in Sensitive Wildlife Species and their Habitats

As described in Chapter 6, "Biological Resources—Wildlife," construction of the pipelines under the Project and Program Components of the Water Delivery Option poses the potential for significant impacts on sensitive vegetation and wildlife species. In addition, SVCSD's new reservoir occurs in an area near Schell Slough that could contribute to indirect impacts on sensitive biological resources. Completion of the City of Petaluma's recycled water distribution system could include construction of, or improvements to, pipelines located in proximity to sensitive biological resources.

The overall impacts associated with these projects are considered cumulatively significant. Implementation of Mitigation Measure Cu-~~3~~2, "Conduct Biological Surveys for Sensitive Biological Resources," would reduce this impact to a less-than-significant level. This measure is described under "Biological Resources—Vegetation" above.

18.2.7 Biological Resources—Aquatic Resources

18.2.7.1 Salinity Reduction and Habitat Restoration Options

Beneficial Impact Cu-10: Increase in Subtidal Habitat

Implementation of the project in conjunction with other projects envisioned in the area could result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Nursery habitat for many species would be greatly enhanced by the implementation of this and other restoration efforts. Ongoing water quality monitoring is proposed and would need to be conducted to ensure no adverse effects on aquatic resources. However, this impact is considered beneficial. No mitigation is required.

18.2.7.2 Water Delivery Option

Although construction activities associated with the Water Delivery Option components and other water and wastewater infrastructure improvement projects have the potential to degrade surface water quality and adversely affect fish, such degradation would be temporary and local in nature. Most tertiary treated waste water disposal projects are being conducted to reduce the long-term discharges and improve water quality, thereby benefiting aquatic species. No mitigation is required.

18.3 Other Required Analyses

18.3.1 Relationship between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term uses of the environment that would occur with restoration include the impacts on existing wetlands and habitat and those from construction-related activities. However, in the long term, the site is expected to be substantially more productive for habitat and wildlife values.

18.3.2 Irreversible or Irretrievable Commitments of Resources

The project would result in the irretrievable commitment of fossil fuels and other energy sources to build, operate, and maintain the wetlands. The restoration of the site to wetlands, however, is not considered an irreversible commitment because the landscape could be converted to other land uses in the future.

18.3.3 Growth-Inducing Impacts

~~Section 15162.2(d) of the State CEQA Guidelines requires that an EIR address the potential growth-inducing impacts of a proposed project. Specifically, the EIR shall "discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing either directly or indirectly, in the surrounding environment."~~ NEPA requires the analysis of growth inducing effects (40 C.F.R. 1508.8[b]) and t~~T~~hese effects are described for the various project components below.

18.3.3.1 Salinity Reduction and Habitat Restoration Options

The salinity reduction and habitat restoration components of the project would not contribute to regional urbanization, as no urban infrastructure or facilities are proposed as part of the project; therefore, they would not result in any growth-inducing effects.

18.3.3.2 Water Delivery Option

The essence of the proposed Napa River Salt Marsh Restoration Project—restoration of an existing degraded salt marsh—would not, in itself, have any growth-inducing impact (i.e., foster economic or population growth, or the construction of additional housing). ~~However,~~ iImplementation of the Water Delivery Option, if selected, would not be growth-inducing for urban development, but could have a growth-inducing impact relative to the potential future use of recycled water for agricultural irrigation.

SVCSD, NSD, and CAC Waste Water Treatment Plants (WWTPs) would be contributing their recycled water to a pipeline designed to put this water to a beneficial use. The proposed project is not proposing to expand their service areas or otherwise expand their existing treatment facilities. These WWTPs have undergone appropriate CEQA analysis for past facility expansions and are not currently constrained in their operations besides the conditions stipulated in their NPDES permits. In summary, construction of the pipeline and use of recycled

water for the project would not induce urban growth because the WWTPs are not increasing discharges beyond what they could already be discharging.

As described below, the growth of agricultural activity in the north bay region is currently constrained by the availability of water suitable for irrigation. The provision of recycled water suitable for agricultural irrigation could foster economic growth in the north bay region, especially relative to vineyard operations in Napa and Sonoma Counties. The following describes the background of, and basis for, that conclusion.

Background

Napa and Sonoma Counties have a Mediterranean climate (mild wet winters, warm summers) with relatively low precipitation levels. Despite this relatively low rainfall, Sonoma and Napa Counties comprise one of the most important agricultural regions in the state of California. Agricultural land in Napa and Sonoma Counties consists of a variety of agricultural uses including rangeland, pasture, croplands, and intensive agricultural lands.

Rangeland and pastures are primarily grazing lands for cattle, mostly on the hillsides surrounding the diked wetlands. Croplands typically consist of oat hay and are primarily under dryland production, although productivity can be increased by applying irrigation methods. The majority of the lowlands in the diked baylands consist of field crops because the acidic, poorly drained, and highly saline soils are not favorable for more intensive agricultural practices. The moderately well drained soils in the uplands are more favorable for intensively farmed crops including pears, plums, apples, apricots, nuts, and wine grapes. In Sonoma County, 55% of the farmland is used for wine grapes and apples, yet these industries make up 86% of the annual production value (Northwest Economic Associates 1997). Intensive agriculture brings the highest economic yield in the agriculture sector for both counties; however, its productivity is largely dependent on an adequate water supply for irrigation.

The availability of water for irrigation and other purposes in Napa and Sonoma Counties is limited by a number of factors including, but not limited to, water right issues involving a number of users; low precipitation; saltwater intrusion; and poor soil permeability and aquifer recharge.

Surface water sources in the area include Carneros Creek, Huichica Creek, and other Sonoma Creek and Napa River tributaries. Natural runoff from these creeks into San Pablo Bay is highly variable. The upper elevations in the Coast Ranges have very little snowpack, and permeability of the soil is low. Consequently, the majority of runoff occurs during relatively short rain events, and the base flow is poorly sustained. Small tributary streams are often naturally dry during summer months, and the flows between the wet and dry seasons are highly variable. Additionally, the salinity of the surface water near San Pablo Bay varies seasonally and often fluctuates with the quantity of surface water flows. Surface water sources can be brackish and unsuitable during the dry summer months.

Groundwater is also often used for irrigation purposes. Much of the Napa-Sonoma area overlies the Huichica Formation, which is a clay-rich, well-consolidated formation that is low yielding for groundwater. Aquifers underneath the baylands are also in limited supply and often brackish. The groundwater wells meet drinking water standards; however, concentrations of chloride, sodium, or boron are high enough to cause some agricultural concerns.

Recycled water is used in both Napa and Sonoma Counties for irrigation; it irrigates pasture, forage, vineyards, and orchard operations, with forage and pasture being the most prevalent agricultural uses. Currently, about 7,800 acres are irrigated with recycled water.

Increase in Intensive Agricultural Activity

Based on the role that intensive agriculture plays in the regional economy, the importance of irrigation to intensive agriculture, and the existing constraints related to local water sources, the increased availability of, and accessibility to, recycled water in Napa and Sonoma Counties afforded by the Water Delivery Option would likely lead to increased intensive agricultural activity in the region. In particular, vineyard operations could increase, based on economic considerations compared to other types of intensive agriculture. The exact nature, extent, and location(s) of increases in agricultural activity are unknown because converting from passive agriculture to active agriculture or changing intensive agriculture would be a decision made by individual property owners/operators.

It is not anticipated that the provision of recycled water through the Water Delivery Option would result in the conversion of land from agricultural use to urban/suburban development. Title 22, Division 4 of the California Code of Regulations establishes the minimum water quality criteria for various use categories of recycled water. The level of treatment for the recycled water associated with the Water Delivery Option allows the water to be used for irrigation, wetlands, and industrial purposes. The recycled water is not potable.

Napa and Sonoma Counties are, and have long been, occupied predominantly by agricultural uses. Based on history and the extent of these agricultural uses, and the associated general plan and zoning land use designations, the potential for conversion of land from agricultural use to industrial use is considered remote. More likely, the availability of recycled water would reduce the potential for land use conversion in the agricultural portions of Napa and Sonoma Counties by making agricultural operations more economically viable.

Environmental Impacts

The growth inducement described above poses the potential for environmental impacts. The introduction of, or increase in, agricultural irrigation is not expected to notably affect hydrology or water quality, based on state regulations

governing the use and quality of recycled water (i.e., runoff of recycled water is prohibited from leaving the irrigated site).

The availability of recycled water is anticipated to supplement the irrigation supply for existing intensive agricultural areas or enable the conversion of dryland farming areas to irrigated crops. It is not expected to result in the conversion of undisturbed natural areas to agricultural use. As such, potential impacts on biological resources would generally be limited to changes in the nature and activity level of existing disturbed (agricultural) areas. Similarly, potential impacts related to cultural resources, geology and soils, hazardous materials, and public recreation access would be limited by the fact that the change or increase in agricultural activities would likely occur in existing disturbed areas.

No significant land use impacts are expected to occur because the increase in agricultural activities would not represent a notable change in the general nature of land use. Increased agricultural activity may result in increased traffic and associated vehicular air pollutants and noise. Given the rural nature of the general area and the likelihood that the impacts would be localized, the impacts are anticipated to be less than significant.

Overall, the growth inducement associated with the Water Delivery Option is anticipated to have a less-than-significant impact on the environment.

Chapter 19
List of Recipients

19.1 Agencies and Officials

Association of Bay Area Governments
CALFED Bay-Delta Program
California Department of Fish and Game
California Department of Health Services
California Department of Transportation
California Resources Agency
California State Coastal Conservancy
City of American Canyon
City of Petaluma
City of Vallejo
Marin/Sonoma County Mosquito Abatement District
Metropolitan Transportation Commission
Napa County Agricultural Commissioner
Napa County Mosquito Abatement District
Napa County Planning Department
Napa County Public Works Department
Napa County Resource Conservation District
Napa Sanitation District
Napa Valley Economic Development Corporation
National Marine Fisheries Service
Office of Assemblywoman Patricia Wiggins
Office of State Senator Wesley Chesbro
Office of U.S. Representative George Miller
Office of U.S. Representative Nancy Pelosi
Office of U.S. Representative Ellen Tauscher
Office of U.S. Representative Mike Thompson
Office of U.S. Representative Lynn Woolsey
Office of U.S. Senator Barbara Boxer
Office of U.S. Senator Dianne Feinstein
San Francisco Bay Conservation and Development Commission
San Francisco Bay Regional Water Quality Control Board
San Francisco International Airport
San Pablo Bay National Wildlife Refuge
Solano County Mosquito Abatement District
Sonoma County Water Agency

Southern Sonoma County Resource Conservation District
State Lands Commission
U.S. Army Corps of Engineers
U.S. Coast Guard, Eleventh District
U.S. Department of Agriculture
U.S. Department of Commerce, National Oceanic and Atmospheric Administration
U.S. Department of Transportation, Federal Highway Administration
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Navy, Naval Facilities Engineering Command
USDA Natural Resources Conservation Service, Water Resource Planning
University of California, Davis, Dept. of Civil and Environmental Engineering

19.2 Other Organizations

Bay Planning Coalition
Bay Keeper
California Waterfowl Association
Citizens Committee to Complete the Refuge
Coalition to Restore Urban Waters
Ducks Unlimited
Fishermen's Association
Friends of the Napa River
Historical Resources Northwest Information Center
Marin Audubon Society
Marketing Association Half Moon Bay Fisherman's Club
Napa County Land Trust
National Audubon Society
National Fish and Wildlife Foundation
North Bay Agricultural Alliance
Pacific Gas and Electric Company
Point Reyes Bird Observatory
Romberg Tiburon Center
San Francisco Bay Bird Observatory
San Francisco Bay Joint Venture
San Francisco Estuary Institute
Save San Pablo Baylands
Save The Bay
Sierra Club, Redwood Chapter
Sierra Club, San Francisco Bay Chapter
Solano Audubon Society
The Bay Institute
The Nature Conservancy, California Field Office

19.3 Other Interested Persons

All individuals on the Napa River Salt Marsh Restoration Project mailing list will be notified of the availability of this report.

Chapter 20
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Chapter 21
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Index

Appendix A

Initial Study

ENVIRONMENTAL CHECKLIST FORM

1. Project Title:	Napa River Salt Marsh Restoration Project
2. Lead Agency Name and Address:	Department of Fish & Game Robert Floerke 7329 Silverado Trail Napa, CA 94558 707/944-5500
3. Contact Person and Phone Number:	Nadine Hitchcock 510-286-4176
4. Project Location:	The Napa River Salt Marsh (Napa River Unit) is located on the west side of the Napa River between the shoreline of San Pablo Bay and the Southern Pacific Railroad line in Napa and Solano Counties, California.
5. Project Sponsor's Name and Address:	California Department of Fish and Game P.O. Box 47 Yountville, CA 94599 U. S. Army Corps of Engineers 333 Market Street San Francisco, CA 94105
6. General Plan Designation:	Solano County: Land Extensive Agriculture Napa County: Agriculture, Watershed, Open Space Sonoma County: Extensive Agriculture Marin County: Extensive Agriculture, Residential, Open Space, Recreation
7. Zoning:	Zoning conforming with general plan designations described above.

8. **Description of Project:** The California State Coastal Conservancy (Coastal Conservancy), together with the U.S. Army Corps of Engineers (Corps) and the California Department of Fish and Game (DFG), propose the salinity reduction and habitat restoration of Napa Salt Marsh, DFG's 9,850-acre property within the Napa River Unit. The Napa River Salt Marsh Restoration Project objective is to restore tidal salt marsh and ecologically related habitats to this property to support increased populations of endangered species, migratory waterfowl, shorebirds, and anadromous and native fish. The project consists of the construction of new water-intake and -discharge structures, replacement and modification of onsite canals and pipelines, and levee breaches to reduce pond salinities and to restore ponds to tidal action, thereby providing a large increase in slough habitat and tidal channels. Salinity reduction will be achieved through the use of tidal Napa River water and possibly through the use of tertiary treated wastewater (i.e., recycled water). Water that is conveyed from the ponds back into the river will be carefully monitored to ensure it does not exceed water quality standards permitted by the San Francisco Regional Water Quality Control Board (RWQCB). Once salinities are reduced, the existing levees on some of the ponds will be breached to produce a natural, selfsustaining habitat that can adjust to naturally occurring changes in physical processes, with minimum ongoing intervention. Other ponds will be managed using water control structures.

9. **Surrounding Land Uses and Setting:**
Napa Slough borders the west side of the project area, and agricultural lands lie to the west and north. The Napa River lies to the east of the project, and to the south are U.S. Fish and Wildlife Service (USFWS)-owned tidal lands and seasonal wetlands. A residential neighborhood is adjacent to Pond 8 on the east side of Edgerley Island.

10. **Other Public Agencies Whose Approval Is Required:**
Regional Water Quality Control Board
United States Fish and Wildlife Service
National Marine Fisheries Service
United States Army Corps of Engineers
State Water Resources Control Board
Department of Fish and Game
State Historic Preservation Officer
Napa County
Solano County
Sonoma County
Bay Area Air Quality Management District

Environmental Factors Potentially Affected:

The environmental factors checked below would potentially be affected by this project (i.e., the project would involve at least one impact that is a "potentially significant impact"), as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agricultural Resources	☒ Air Quality
☒ Biological Resources	☐ Cultural Resources	☒ Geology/Soils
☐ Hazards and Hazardous Materials	☒ Hydrology/Water Quality	☐ Land Use/Planning
☐ Mineral Resources	☐ Noise	☐ Population/Housing
☐ Public Services	☐ Recreation	☐ Transportation/Traffic
☐ Utilities/Service Systems	☒ Mandatory Findings of Significance	

Determination:

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions to the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have an impact on the environment that is "potentially significant" or "potentially significant unless mitigated" but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards and (2) has been addressed by mitigation measures based on the earlier analysis, as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the project, nothing further is required.

____________________	____________________
Signature	Date
Robert Floerke	____________________
Printed Name	For

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
I.	**AESTHETICS.** Would the project:				
a.	Have a substantial adverse effect on a scenic vista?	☐	☐	■	☐
b.	Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings along a scenic highway?	☐	☐	■	☐
c.	Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	■	☐
d.	Create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area?	☐	☐	☐	■

a. The project site is located near Highway 37, a California Department of Transportation- (Caltrans-) eligible "scenic roadway" in Solano and Sonoma Counties (Caltrans 2000). Highway 37 is also listed in the Sonoma and Solano County general plans as a scenic roadway (Sonoma County Planning Department 1998, Solano County 1999). The restoration project will not cause adverse effects to the scenic vista. Currently, the view consists of salt ponds and agricultural lands. As the project proceeds, it will provide a scenic view of the marsh habitat. Development of the marsh habitat will involve flooding and flushing portions of the area to reduce salinity. If recycled water is used in the desalination process, an existing pipeline will be extended to the project site. However, because this pipeline would be underground, it would not cause an adverse change in views.

b. A site visit and preliminary analysis of aerial photography did not reveal any scenic resources on site as the project area is composed of salt evaporation ponds. Scenic resources such as trees, rock outcroppings, and historic buildings could occur along Highway 37 near the proposed project. No such resources were identified during a review of aerial photography. Therefore, it is not anticipated that such resources will be affected by the project.

c. The restoration project will not degrade the existing visual character or quality of the site. The conversion of the project area from salt evaporation ponds to tidal marsh will likely enhance the visual quality of the site. Salt evaporation ponds are notable for the different colors caused by salt production. These colors range from red/orange to blue. The marsh habitat will resemble more "natural" colors like mud brown and water blue. The construction activities in the project area may have a temporary adverse effect on the visual quality of the site. Because of the short-term nature of the activities, this impact will be temporary.

d. The project will not involve installation of any new lighting systems or sources of glare.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
II.	**AGRICULTURAL RESOURCES.** In determining whether impacts on agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation. Would the project:				
a.	Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	❑	❑	■	❑
b.	Conflict with existing zoning for agricultural use or conflict with a Williamson Act contract?	❑	❑	■	❑
c.	Involve other changes in the existing environment that, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	❑	❑	■	☐

a. Based on an initial review of Napa and Solano County general plans, the proposed project will not require the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Napa County 1996, Solano County 1999). A more thorough analysis will be provided in the environmental impact report/environmental impact statement (EIR/EIS), including an examination of adjacent farmlands and the indirect effects caused by the proposed project on these lands.

b. Most of the project area is contained within Napa and Solano Counties. If recycled water were used in the desalination process, a pipeline for water conveyance would be located in a small portion of Napa and Sonoma Counties. The northern portion of the project area is located in Napa County and the lands are designated as "agriculture, watershed, and open space." This land use designation does not conflict with the project's intended uses. Both Solano and Sonoma Counties have designated the remaining areas of the proposed project area as "land extensive agriculture." This land use designation does not conflict with the project's intended uses.

c. Currently, the agricultural lands north and west of the project site are used for cultivating hay. If recycled water is used for the project and made available to adjacent agricultural landowners upon completion of the desalinization portion of the project, the types and intensity of agricultural use may change, but are not anticipated to change to nonagricultural uses.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
III.	**AIR QUALITY.** When available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a.	Conflict with or obstruct implementation of the applicable air quality plan?	☐	■	☐	☐
b.	Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	■	☐
c.	Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is a nonattainment area for an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?	☐	☐	■	☐
d.	Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	■
e.	Create objectionable odors affecting a substantial number of people?	☐	☐	■	☐

a. The potential air quality impacts of the project are limited to short-term construction-generated emissions, notably dust and vehicle emissions. The Bay Area Air Quality Management District construction requirements concerning particulate matter and organic compounds will ensure that construction impacts are less than significant. Additional evaluation and analysis will be provided in the EIR/EIS.

b. Because of the limited earthmoving activity associated with the project, a violation of air quality standards is not expected. The EIR/EIS will identify the project's contribution to key air quality pollutants and relationship to air quality standards.

c. The air pollutants potentially generated by the project during construction-related activities will include dust and particulate matter. Emissions from construction vehicles will be minor because construction-related activities will be temporary and there will be relatively few construction vehicles at the site. Construction workers will be exposed to dust for only very short periods of time.

d. The lack of nearby sensitive receptors and low pollutant concentrations indicate there will be no impact on sensitive receptors.

e. Restoration is not anticipated to create objectionable odors; the system would be managed to minimize likelihood of algal blooms and fish kills that would be potential sources of odors. The project is also anticipated to decrease objectionable odors by improving tidal circulation.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
IV.	**BIOLOGICAL RESOURCES.** Would the project:				
a.	Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	■	❑	❑	❑
b.	Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	■	❑	❑	❑
c.	Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrological interruption, or other means?	■	❑	❑	❑
d.	Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	■	❑	❑	❑
e.	Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	❑	❑	■	❑
f.	Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan?	❑	❑	❑	■

a. The proposed project would restore native habitats and is expected to provide a net long-term benefit to native species. However, implementation may adversely affect, at least in the short term, individuals or habitat for several state- or federally listed species and species of concern, including soft bird's-beak, Mason's lilaeopsis, Pacific cordgrass, Suisun Marsh aster, Delta tule pea, Marin knotweed, California clapper rail, California black rail, western snowy plover, salt marsh harvest mouse, Sacramento River winter-run chinook salmon, Sacramento splittail, steelhead trout, and other nonlisted species that could be listed over the life of the proposed project. The impacts on these species and their habitats will be evaluated and discussed in the EIR/EIS.

b. The proposed project is intended to help restore sensitive natural communities. However, in the restoration process, the project could potentially adversely affect sensitive natural communities identified by DFG and USFWS, including coastal brackish marsh and northern coastal marsh. The impacts on these habitats or communities will be evaluated and discussed in the EIR/EIS.

c. The proposed project is expected to result in the long-term increase in the functions and values of coastal marsh wetlands in San Pablo Bay. Implementation, however, may involve interruption or modification of hydrologic function, including filling of coastal salt and brackish marsh wetlands and sloughs through designed levee breaches, water diversions, or other means. These habitats are likely to be considered jurisdictional waters of the United States, under Section 404 of the Clean Water Act. The proposed project's effects on federally protected wetlands will be evaluated and discussed in the EIR/EIS.

d. In the long term, the proposed project is expected to enhance native wildlife populations. However, in the short term, the project could interfere with the movement of some native resident or migratory fish or wildlife species and with established resident or migratory wildlife corridors. Changes in water levels could have an adverse impact on established daily movement patterns and loafing sites of high-tide roosting shorebirds and waterfowl. Increased salinity within sloughs and the Napa River could inhibit the movements of migratory anadromous fish such as striped bass, sturgeon, steelhead, and starry flounder. The proposed project could have an adverse impact on native wildlife nursery sites of juvenile steelhead and striped bass if salinity releases impede movement, as well as known rookery sites for the double-crested cormorant and great blue heron. The proposed project would provide a substantial long-term net benefit for many species, but the resulting altered habitats may modify wildlife use of the site. The proposed project's effects on wildlife, migratory corridors, and fish usage will be evaluated and discussed in the EIR/EIS.

e. The proposed project is expected to be consistent with local policies regarding environmental protection and restoration and local tree ordinances. The proposed project's impacts on these policies and ordinances will be evaluated and discussed in the EIR/EIS.

f. According to planning staff of the Napa County planning office, Napa County does not have any habitat conservation or natural community conservation plans (Bardona pers. comm.). In Solano County, the Solano County Water District is in the preliminary stages of habitat conservation planning. It is currently unclear what areas will be covered by their plan or what areas of the county will be considered mitigation sites (Okita pers. comm.). Information is being gathered regarding habitat conservation planning in Sonoma County. The project could potentially conflict with habitat conservation planning in Solano County and/or Sonoma County. This potential conflict will be addressed in the EIR/EIS.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
V.	**CULTURAL RESOURCES.** Would the project:				
a.	Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	❑	❑	■	❑
b.	Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	❑	❑	■	❑
c.	Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	❑	❑	❑	■
d.	Disturb any human remains, including those interred outside of formal cemeteries?	❑	❑	■	❑

a. Existing information regarding potential historical and archaeological resources within the study area is limited. Structures such as water control facilities, small docks, and buildings associated with salt production, duck clubs, ranching, and other postsettlement land uses are located in several areas throughout the former salt pond complex. These structures have not been evaluated for potential historic significance. There are archaeological records of Native Americans living in the vicinity of Napa Marsh on Suscol Creek and Carneros Creek, but because the actual project area was a tidal salt marsh prior to European settlement, it is unlikely that significant archaeological resources, including human remains, are present. The Corps is planning to conduct site-specific surveys to inventory and evaluate the absence/presence of significant historical and archaeological resources. The findings of these surveys will be evaluated and discussed in the EIR/EIS.

b. Please see response to "a" above.

c. No unique paleontological resources or geologic features are known in the project area, but no formal surveys have been made. The Corps plans to conduct site-specific cultural resource surveys, which will be evaluated and discussed in the EIR/EIS.

d. Please see response to "a" above.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
VI.	**GEOLOGY AND SOILS.** Would the project:				
a.	Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
	1. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	❑	❑	■	❑
	2. Strong seismic groundshaking?	❑	❑	■	❑
	3. Seismic-related ground failure, including liquefaction?	❑	❑	■	❑
	4. Landslides?	❑	❑	■	❑
b.	Result in substantial soil erosion or the loss of topsoil?	■	❑	❑	❑
c.	Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse?	■	❑	❑	❑
d.	Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	❑	❑	■	❑
e.	Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater?	❑	❑	❑	■

a. The project will result in levee modifications and the installation of structures that could be lost during an earthquake, strong seismic groundshaking, or liquefaction. The project is in an area not subject to landslides because of the small elevation differences. However, because structures will be engineered to withstand seismic events to the extent practicable, the effects of such events are expected to be less than significant. It is particularly important to ensure that levee improvements adjacent to Highway 37 are seismically sound because a large number of people travel along this corridor. Facilities in this area will also be engineered to prevent the loss of structures and minimize public effects, and these effects are anticipated to be less than significant. These effects will be analyzed and evaluated in the EIR/EIS.

b. Depending on the size of the levee breaches and amount of scour in adjacent slough channels, there could be substantial erosion of existing mudflat and slough marsh habitat in the project area. These effects will be analyzed and evaluated in the EIR/EIS.

c. Please see response to "a" above.

d. The project is not located on expansive soils.

e. Wastewater disposal is not proposed as part of the project. Recycled water is fully-treated wastewater, and will be included as a water delivery alternative.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
VII.	**HAZARDS AND HAZARDOUS MATERIALS.** Would the project:				
a.	Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	■	☐
b.	Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	■
c.	Emit hazardous emissions or involve handling hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	■
d.	Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	■
e.	Be located within an airport land use plan area or, where such a plan has not been adopted, be within two miles of a public airport or public use airport, and result in a safety hazard for people residing or working in the project area?	☐	☐	■	☐
f.	Be located within the vicinity of a private airstrip and result in a safety hazard for people residing or working in the project area?	☐	☐	☐	■
g.	Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	■
h.	Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	■

a. Except for construction materials, the project will not require the transport or use of hazardous materials. Typical construction-related materials, such as fuels and oils, will be used during construction. Construction workers may therefore be exposed to dust or emissions containing these materials. This impact is considered temporary and less than significant. Standard construction

procedures will be implemented to reduce the emissions of dust or other pollutants during the proposed project. Qualified personnel will evaluate all potentially contaminated areas, if encountered during construction, in the context of applicable local, state, and federal regulations governing hazardous waste. Handling and storage of fuels, flammable materials, and common construction-related hazardous materials are governed by California Occupational Safety and Health Administration (Cal/OHSA) standards for storage and fire prevention. These effects will be evaluated and discussed in the EIR/EIS.

b. Though the bittern and hypersaline brines are not formally classified as a "hazardous material," they pose a toxic risk from accidental releases into existing water bodies. The removal of the bittern and hypersaline brines, and potential toxic releases will be addressed in water quality.

c. The proposed project is not in the vicinity of an existing or proposed school.

d. Please see the response to "a" above.

e. The Napa County Airport is located approximately 1 mile from the project. However, the project will pose no significant safety hazard for people working or residing in the area as no new lighting systems, sources of glare, tall structures, or significant sources of noise are associated with the project.

f. The project area is not located within the vicinity of a private airstrip.

g. The proposed project would not interfere with an adopted emergency response plan or emergency evacuation plan, because construction-related activities would be located off the primary road network.

h. Implementation of the proposed project would not expose people or structures to a risk of wildland fires because of the lack of nearby urbanized areas and flammable wildlands. Any potential increase in fire hazards at the project site will be minimized because construction staff will adhere to all rules and regulations regarding the handling and storage of fuels and flammable materials.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
VIII.	**HYDROLOGY AND WATER QUALITY.** Would the project:				
a.	Violate any water quality standards or waste discharge requirements?	■	❑	❑	❑
b.	Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, resulting in a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	❑	❑	❑	■
c.	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation onsite or offsite?	■	❑	❑	❑
d.	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding onsite or offsite?	❑	❑	■	❑
e.	Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	❑	❑	■	❑
f.	Otherwise substantially degrade water quality?	❑	❑	❑	■
g.	Place housing within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	❑	❑	❑	■
h.	Place within a 100-year flood hazard area structures that would impede or redirect floodflows?	❑	❑	■	❑
i.	Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	❑	❑	■	❑

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
j.	Contribute to inundation by seiche, tsunami, or mudflow?	❑	❑	❑	■

a. Restoration project alternatives have the potential to discharge contaminants that have accumulated in the salt ponds to receiving waters as a result of tidal or mechanical exchange and mixing of water with salt pond sediments. Potential constituents of concern that could be discharged to receiving waters include saline and other inorganic compounds, temperature, sediment, oxygen-demanding substances, nitrogen and phosphorus, and trace metals. A potential concern is also the long-term dissolution of minerals into receiving waters from previously precipitated deposits remaining in the salt ponds. Discharges associated with project alternatives will need to be designed to protect beneficial uses in the receiving waters and comply with applicable state and federal water quality regulations including mixing zone restrictions and numerical water quality criteria. The impacts are considered potentially significant and will be evaluated and discussed in the EIR/EIS.

b. Groundwater will not be affected as a result of implementing the project because no groundwater will be used, and there will not be any substantial excavations that could intercept groundwater or alter groundwater flow paths. Therefore, no impacts on groundwater are anticipated.

c. The project will involve changes to the existing flow patterns of the tidal prism within the ponds and the Napa River. By allowing water to flow in and out of the salt ponds, the rate, volume, and direction of water exchange will change and could subsequently cause changes in sedimentation patterns within the Napa River, in addition to the initial sediment deposition in the salt ponds. In addition, changing the tidal prism within the Napa River may change flow patterns that can alter patterns of erosion and channel scour along streambanks, levees, and the main river channel. Changes in sedimentation patterns can cause impacts on human-made structures within the water bodies, alter water quality, and affect aquatic habitat important to vegetation, aquatic organisms, and terrestrial wildlife that depend on the aquatic habitat. The impacts are considered potentially significant and will be evaluated and discussed in the EIR/EIS.

d. Levee and channel modifications that are implemented or result from implementation of restoration project alternatives may also alter flooding patterns within the salt ponds and Napa River channel. Changing the tidal prism may cause small changes in the pattern of floodflow within the Napa River. The changes are expected to be small and result in minor changes to other resource issues such as inundation patterns, changes to habitat features, and exposure of structures to flooding velocities or inundation patterns. Their impacts are considered less than significant.

e. The salt ponds are currently exposed to storm events. As a result of opening the salt ponds to tidal exchange with the Napa River, the receiving waters (Napa River and San Pablo Bay) will be exposed to stormwater runoff from the salt ponds. There would not be any appreciable effects on stormwater conveyance or management practices because the project area is not associated with any other developed stormwater facilities. However, stormwater runoff from the salt ponds may contain elevated concentrations of contaminants of concern. The stormwater water quality impacts are considered less than significant because the incremental discharge of contaminants during storm events to receiving waters will be relatively negligible compared to the dilution from typical high

flow conditions during the winter storm season and/or floodflows within the receiving waters. The potential water quality effects of the project during summer low-flow periods (discussed under checklist question "a") are much more important to beneficial uses of the water resources and compliance with water quality regulations.

f. Potential water quality impacts are discussed under checklist question "a."

g. No housing would be placed within the 100-year floodplain. Therefore, there would be no impact.

h. As described in checklist question "d," under the project alternatives, modifications will occur to levees and channels within the salt ponds that may change floodflow and inundation patterns. Because the area is very level and located essentially at sea level, the potential changes to flooding conditions during a 100-year flow are expected to be less than significant.

i. The project area is an undeveloped area of the tidal floodplain of San Pablo Bay proposed for habitat restoration. The site is not expected to expose people to hazards from flood events or inundation.

j. The project may be currently exposed to inundation because it lies within a floodplain and is adjacent to San Pablo Bay. However, the project alternatives would not alter the exposure to inundation.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
IX.	**LAND USE AND PLANNING.** Would the project:				
a.	Physically divide an established community?	❑	❑	❑	■
b.	Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	❑	❑	❑	■
c.	Conflict with any applicable habitat conservation plan or natural community conservation plan?	❑	❑	❑	■

a. The project is not within an established community.

b. The following plans and polices will be reviewed for consistency with the proposed project:
- Coastal Zone Management Act/San Francisco Bay Plan
- Long Term Management Strategy [U.S. Environmental Protection Agency, Corps, State Water Quality Control Board, Regional Water Quality Control Board, and Bay Conservation and Development Commission]
- San Francisco Estuary Project Comprehensive Conservation Management Plan
- Ecosystem Restoration Program Plan [CALFED Bay-Delta Program]
- Bay Trail Plan
- Solano County General Plan
- Napa County General Plan
- Sonoma County General Plan

As discussed in the agricultural section, a preliminary review of land use designations within the project area found that Sonoma and Solano County designations does not conflict with the project's intended uses.

c. According to planning staff of the Napa County planning office, Napa County does not have any habitat conservation or natural community conservation plans (Bardona pers. comm.). In Solano County, the Solano County Water District is in the preliminary stages of habitat conservation planning. It is currently unclear what areas will be covered by their plan or what areas of the county will be considered mitigation sites (Okita pers. comm.). Information is being gathered regarding habitat conservation planning in Sonoma County. The project could potentially conflict with habitat conservation planning in Solano County and/or Sonoma County. This will be addressed in the EIR/EIS.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
X.	**MINERAL RESOURCES.** Would the project:				
a.	Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	❑	❑	■	❑
b.	Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	❑	❑	❑	■

a. The project site was formerly used for harvesting the salt left behind from the evaporation of bay water. However, the project site has been defunct as a salt-producing area for 10 years, and there are many other sources of salt in the region and state that are able to meet salt demand. Therefore, the project would result in no significant loss of mineral resources.

b. The project site is not designated as an important mineral resource recovery site in local plans.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XI.	**NOISE.** Would the project:				
a.	Expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies?	☐	☐	■	☐
b.	Expose persons to or generate excessive groundborne vibration or groundborne noise levels?	☐	☐	■	☐
c.	Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	■
d.	Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	■	☐
e.	Be located within an airport land use plan area, or, where such a plan has not been adopted, within two miles of a public airport or public use airport and expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	■
f.	Be located in the vicinity of a private airstrip and expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	■

a. Construction would be expected to generate short-term elevation of noise levels but would not violate noise standards for nearby communities. These effects will be evaluated and discussed in the EIR/EIS.

b. Residents near the project area will not be exposed to excessive groundborne vibration or groundborne noise levels. These effects will be evaluated and discussed in the EIR/EIS.

c. The project would not produce a permanent increase in ambient noise levels.

d. Please see answer to "a" above.

e. The Napa County Airport is approximately 1 mile from the northeast corner of the project. However, construction related noise will not affect ambient noise levels at the Napa County Airport.

f. The project area is not located within the vicinity of a private airstrip.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XII.	**POPULATION AND HOUSING.** Would the project:				
a.	Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)?	❑	❑	❑	■
b.	Displace a substantial number of existing housing units, necessitating the construction of replacement housing elsewhere?	❑	❑	❑	■
c.	Displace a substantial number of people, necessitating the construction of replacement housing elsewhere?	❑	❑	❑	■

a. The project will not induce population growth because it does not provide new homes or businesses and does not provide for the expansion of facilities that induce growth. The possible use of recycled water at the project site would not induce growth because the water is nonpotable.

b. The project will not result in the displacement of any housing units or people. Consequently, there will be no population and/or housing impacts associated with the project.

c. Please see answer to "b" above.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XIII. PUBLIC SERVICES. Would the project:				
a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or a need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services:				
Fire protection?	☐	☐	☐	■
Police protection?	☐	☐	☐	■
Schools?	☐	☐	☐	■
Parks?	☐	☐	☐	■
Other public facilities?	☐	☐	■	☐

a. The proposed project will not increase the human population in the area. Therefore, the service ratios and response times or performance objectives of the local fire protection and police protection will not be affected. Demand for schools will not change. It is not anticipated that other public facility providers will be affected. Public service effects will be evaluated in the EIR/EIS.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XIV.	**RECREATION.** Would the project:				
a.	Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	■	☐
b.	Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	■	☐

a. There is a duck club on the property, but the project is not expected to create any substantial increase in the use of that facility. A recreation plan will be included in the project. It is anticipated that during the recreation planning process, the extent and type of public access that will be allowed on the project site will be determined. Public access and its impacts will be analyzed and evaluated in the EIR/EIS.

b. The project includes construction and expansion of some, but a limited number of, recreational facilities. Facilities will be located away from endangered species habitat to avoid adverse effects. New public facilities and their effects on the environment will be analyzed and evaluated in the EIR/EIS.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XV.	**TRANSPORTATION/TRAFFIC.** Would the project:				
a.	Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?	❑	❑	■	❑
b.	Cause, either individually or cumulatively, exceedance of a level-of-service standard established by the county congestion management agency for designated roads or highways?	❑	❑	■	❑
c.	Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	❑	❑	❑	■
d.	Substantially increase hazards because of a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	❑	❑	■	❑
e.	Result in inadequate emergency access?	❑	❑	❑	■
f.	Result in inadequate parking capacity?	❑	❑	❑	■
g.	Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	❑	❑	❑	■

a. The project would not result in any substantial long-term increase in traffic. Project-related activities would require only a limited amount of equipment at any one time and only at times related to construction. Project-related traffic is not anticipated to substantially increase traffic volumes. Equipment would be parked in designated construction areas at the end of each work day and adequate signage will be placed to warn passing motorists about the construction activities. Traffic and its impacts will be analyzed and evaluated in the EIR/EIS.

b. Please see answer to "a" above.

c. The project would not affect air traffic patterns for the nearby Napa County Airport.

d. The project may require construction access to/from Highway 37. Such access would be in accordance with Caltrans requirements for safe ingress/egress.

e. The project would not introduce residents or result in any other reasons to increase emergency access.

f. The project does not require or propose permanent parking.

g. The project is neither a residential nor employment-generating land use, and there is no need for alternative transportation facilities.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XVI.	**UTILITIES AND SERVICE SYSTEMS.** Would the project:				
a.	Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	❑	❑	❑	■
b.	Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❑	❑	■	❑
c.	Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❑	❑	❑	■
d.	Have sufficient water supplies available to serve the project from existing entitlements and resources, or would new or expanded entitlements be needed?	❑	❑	❑	■
e.	Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	❑	❑	❑	■
f.	Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	❑	❑	❑	■
g.	Comply with federal, state, and local statutes and regulations related to solid waste?	❑	❑	❑	■

a. The proposed project is not expected to release discharges that exceed the requirements of the San Francisco RWQCB. A discussion regarding the mechanisms that will be implemented to ensure that discharge will not exceed RWQCB Standards will be included in the EIR/EIS.

b. The proposed project may require the expansion of an existing pipeline to the salt ponds/project area. The recycled water from the pipeline will provide a temporary source of fresh water for the desalinization process. Once the salt removal process is completed, the pipeline route will be altered to provide water to adjacent agricultural lands. Therefore, the environmental impact caused by the pipeline expansion will be temporary. After the ponds are desalinated, some amount of recycled water may be used to manage the ponds in the long-term.

c. The project will have no effect on stormwater facilities.

d. No new or expanded water supply entitlements would be needed, as the project will use tidal water and possibly some recycled water.

e. The project will create no additional demand on wastewater treatment providers.

f. The project would not generate substantial amounts of solid waste and would not affect a landfill.

g. The project would comply with federal, state, and local solid waste standards.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
XVII. MANDATORY FINDINGS OF SIGNIFICANCE				
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	■	❑	❑	❑
b. Does the project have impacts that are individually limited but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	■	❑	❑	❑
c. Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	❑	❑	■	❑

a. As described in Section IV. *Biological Resources,* the project has the potential to result in significant biological resource impacts. There is little likelihood that major periods of California's history or prehistory would be eliminated as a result of the project; however, these impacts will be described and analyzed in the EIR/EIS.

b. Cumulative adverse effects are possible for biological resources because of other proposed restoration areas in San Pablo Bay that could also result in the near-term loss of marsh habitat and a longer timeframe needed for natural ecosystems to replace the marsh habitat. Cumulative adverse effects are also a possibility for some water quality parameters. These impacts will be described and analyzed in the EIR/EIS.

c. As described throughout the preceding checklist sections, the proposed project will not result in any environmental impacts that would cause substantial adverse effects on human beings, either directly or indirectly.

Appendix B

Section 404(b)(1) Compliance

Appendix B
Section 404(b)(1) Compliance

Introduction

The California State Coastal Conservancy (Coastal Conservancy), U.S. Army Corps of Engineers (Corps), and California Department of Fish and Game (DFG) (project sponsors) are proposing a salinity reduction and habitat restoration project for the 9,456-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area (NSMWA) (Napa River Unit). The Napa River Unit is located at the northeast edge of San Pablo Bay, adjacent to the Napa River (Figure 1).

Background on the Napa River Unit

The Napa River Unit was first diked off from San Pablo Bay during the 1850s for hay production and cattle grazing. Dike construction continued for several years. Much of the land was converted in the 1950s to salt ponds for salt production through the solar evaporation of bay water. In the early 1990s, Cargill Salt Company stopped producing salt in the ponds in the west side of the Napa River and sold the evaporator ponds to the State of California, which assigned ownership and management of the ponds to DFG. The parcel was purchased with funds from the Shell Oil Spill Settlement, the State Lands Commission, the Wildlife Conservation Board, and the Coastal Conservancy.

Project Authority and Purpose

The Napa River Salt Marsh Restoration Project is an outgrowth of the *Napa-Sonoma Marsh Restoration Project Phase I and Phase II Feasibility Studies for the Napa River, California*, which was authorized by a resolution adopted on September 28, 1994, by the Committee on Public Works and Transportation of the U.S. House of Representatives (Docket 2448).

The purpose of the project is to restore a mosaic of habitats, including tidal habitats and managed ponds, to this property to support populations of fish and wildlife, including endangered species, migratory waterfowl, shorebirds, and anadromous and resident fish. Other important benefits of the project include improved water quality, the potential use of recycled water, and enhanced public

open space and wildlife-compatible recreation opportunities. The long-term goal is to produce a natural, self-sustaining habitat that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

Related Agreements, Programs, and Studies

Restoration of the Napa River Unit has long been a vision for local resource agencies, conservationists, and planners. It is one of the largest tidal restoration projects on the west coast of the United States and one of many restoration projects throughout the San Francisco Bay area. The Coastal Conservancy and the Corps have entered into a cost-sharing agreement for the analysis and development of the project.

Baywide restoration planning programs have long considered the Napa River Unit. The key programs identifying this site for restoration include

- San Francisco Estuary Project—Comprehensive Conservation and Management Plan; and
- San Francisco Bay Joint Venture—Implementation Strategy.

Relevant studies and analysis of the project include

- *Hydrodynamic Modeling Analysis of Existing Conditions* (Philip Williams and Associates 2002a);
- *Napa Sonoma Marsh Restoration Feasibility Study Phase 2 Stage 1* and *Napa Sonoma Marsh Restoration Feasibility Study Phase 2 Stage 2* (Philip Williams and Associates 2002b, 2002c);
- *Water Quality and Sediment Characterization* (HydroScience Engineers 2002);
- *Baseline Monitoring of the Pond 2A Tidal Restoration Project* (MEC Analytical Systems 2000);
- *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds, San Francisco Bay Estuary, 2000 Progress Report* (Takekawa et al. 2001);
- *Baylands Ecosystem Habitat Goals—A Report of Habitat Recommendations* (Goals Project 1999); and
- *Baylands Ecosystem Species and Community Profiles—Life Histories and Environmental Requirements of Key Plants, Fish, and Wildlife* (Goals Project 2000).

Alternatives Screening Process

The Napa River Salt Marsh Restoration Project includes three primary components—salinity reduction, habitat restoration, and water delivery. Each of these components had numerous alternative approaches to being implemented.

Twenty-four salinity reduction, three supplemental water delivery, and seven habitat restoration options were considered at the screening stage. Of these, 21 salinity reduction options, two water delivery options, and three habitat restoration options were eliminated from further analysis. These options are briefly described below.

Salinity Reduction Options

Salinity reduction options considered but eliminated fell into several categories. These categories and the reasons that the options were eliminated are listed below.

- *Reverse Operation of the Ponds:* These options consisted of reversing the flow so that the higher salinity (northernmost) ponds would discharge into the lower salinity ponds (closest to the bay). Hydrologic modeling indicated that reverse operation would delay the salinity reduction and habitat restoration process because desalination of the lower salinity ponds would be delayed until desalination of the higher salinity ponds had been completed. In addition, the salinity in the lower salinity ponds would increase initially as the water from the upper ponds is discharged to the lower ponds.
- *Concentration of Brine in One or More Central Ponds:* Brine would have been moved from the lower and upper ponds to centrally located holding chamber(s), which would be used to discharge the brine over time; this would have allowed restoration of the remaining ponds to occur sooner than under reverse operation. Preliminary analysis of these options indicated that one or more ponds would have a very large increase in salinity, and (in several scenarios) one or more ponds could dry out completely. In addition, very high water volumes would be required for most of these options. The loss of habitat value and potential long-term damage to one or more ponds associated with desiccation made these options unacceptable.
- *Physical Removal of the Bittern:* Bittern from Pond 7 would have been pumped out and/or scraped up, then disposed of or reused off-site, potentially expediting restoration of the upper ponds. Cost and environmental effects made these options infeasible.
- *Use of Only Recycled Water to Desalinate All Ponds:* This option was designed to eliminate potential impacts on aquatic life from use of Napa River, Napa Slough, or San Pablo Bay water for desalination. However, water-balance calculations indicated that there would not be sufficient recycled water to compensate for net evaporation, much less to desalinate all ponds.
- *Flood Event Salinity Reduction:* Under this option, brine could be discharged only during flood events (or discharged at a higher rate during such periods) since a higher volume of water would be available to dilute the brines and carry the diluted discharge to San Pablo Bay. This option is not a complete desalination option by itself, because this approach cannot be used for the bittern and may not be appropriate for the highest salinity ponds. The

use of floodwaters to help reduce salinity was integrated into two of the salinity reduction options considered in the environmental impact report/environmental impact statement (EIR/EIS) for the project.

Water Delivery Options

Water delivery options considered for salinity reduction included "maximum" recycled water delivery (a combined 15,000 acre-feet per year of recycled water from water/sanitary agencies in the region) and use of groundwater beneath the site.

The Maximum Recycled Water Delivery Option was eliminated from further consideration because the feasibility and timing of constructing a pipeline system to convey recycled water to the project site from all wastewater treatment plants (WWTPs) in the north bay region have not been determined. However, a portion of this option is currently feasible as described under "Water Delivery" in the "General Description" section of the project description below.

Use of site groundwater was eliminated from further consideration because of the relatively small volume of water available, the cost of installing the required wells and water distribution system, the risk of causing saltwater intrusion into the shallow aquifer, and the opposition of the San Francisco Bay Regional Water Quality Control Board (RWQCB) to use of limited potable water for desalination when other options are feasible. However, use of groundwater may be appropriate for select aspects of the long-term maintenance program for the project area.

Habitat Restoration Options

Habitat restoration options considered but eliminated fell into several categories. These categories and the reasons that the options were eliminated are listed below.

- *Species-Focused Options:* The site would have been restored for primary use by specific species such as waterfowl and shorebirds or by endangered species. Maximizing habitat for shorebirds and waterfowl would completely eliminate the largest likely potential for recovery of endangered species and the largest likely potential for increasing tidal marsh and associated ecosystem services (including benefits to the bay) anywhere in the north bay region. Maximizing habitat for endangered species would cause disproportionate negative impacts on shorebirds and waterfowl by eliminating excellent high tide refugia and feeding habitat for the former and substantial feeding and resting habitat for the latter. Species-focused options are particularly difficult to design and do not allow the necessary flexibility needed to manage the multispecies project area. The habitat restoration options that were retained provide suitable habitat for a wide range of existing species.

- *Land Exchange:* This habitat restoration option would have involved integrating activities at adjacent or nearby restoration sites. One option was to exchange the Cullinan Ranch parcel (owned by the U.S. Fish and Wildlife Service [USFWS]) for a DFG parcel in the project area so that land more suitable for tidal marsh restoration would be used to create tidal marsh and a deeply subsided area such as Cullinan would be used to create pond habitat. Although technically and economically sound, this option is logistically infeasible at this time because the terms of congressional funding and USFWS's purchase agreement mandated that Cullinan Ranch be restored.
- *Sediment-Import Options:* Imported sediment would have been placed into the ponds before breaching to avoid or minimize the need for sediment accretion before establishment of marsh vegetation; sediment could have been used to raise grades at the northern ponds to create upland or seasonal wetland habitat. Sediment import may not enhance the environmental values substantially over existing conditions and DFG supports only the limited use of sediment. Additionally, initial calculations have shown that there will be sufficient sediments to fill the ponds naturally. Creation of seasonal wetland or upland habitat is not part of the goals for this project.

Final Project Alternative

The four most feasible salinity reduction and habitat restoration options were then combined to create 16 possible alternatives, each with recycled water. A no-recycled-water alternative was also added. These alternatives were screened based on cost effectiveness, feasibility, environmental impacts, and achievement of overall project objectives for salinity reduction and habitat restoration. The project sponsors will formally identify the proposed project or "preferred alternative" in the final EIR/EIS for the project. However, the alternative projected as the preferred alternative is Alternative 6, "Napa River and Napa Slough Discharge with Breach of Pond 3 and 4/5, Recycled Water Delivery, and Mixture of Ponds and Tidal Marsh.

Project Description

General Description

Both salinity reduction and habitat restoration are required to complete the Napa River Salt Marsh Restoration Project; the appropriate options for these components of the project, along with the appropriate water delivery option (all analyzed in the EIR/EIS for the project), have been combined to create the proposed project. The following components are part of the proposed project.

Salinity Reduction: Napa River and Napa Slough Discharge, with Breach of Pond 3 and 4/5

The salinity reduction process would occur in a phased approach, decoupling desalination of the upper ponds from desalination of the lower ponds. Primary discharges from the upper ponds would be to Napa Slough, and primary discharges from the lower ponds would be to the Napa River. The use of recycled water for dilution of the upper ponds would be included in this option. The southeast corner of the Pond 3 levee would be breached for 50 feet to accelerate the salinity reduction process and reduce project costs. Subsequent to the breaching and salinity reduction of Pond 3, the east side of Pond 4 would also be breached for 50 feet. Together, these two breaches would be the fastest way to accelerate the salinity reduction process safely and reduce project costs.

Water Delivery

This project component focuses on delivery of recycled water to the project area and contains two components—one of them project-specific in nature (the "Water Delivery Project Component") and the other programmatic (the "Water Delivery Program Component"). Project-specific delivery would occur from the Sonoma Valley County Sanitation District (SVCSD) WWTP, the Napa Sanitation District (NSD) WWTP, and the City of American Canyon (CAC) WWTP (Figure 2). Programmatic recycled water delivery could come from other WWTPs in the Sonoma County Water Agency's jurisdiction (Figure 2).

Habitat Restoration: Mixture of Tidal Marsh and Managed Ponds

This option provides a balanced mix of tidal marsh habitat and managed pond habitat, with an emphasis on restoring Ponds 3, 4, and 5 to tidal marsh and maintaining the remaining ponds as managed ponds. Some design features would be employed to accelerate restoration, including limited excavation of historic slough channels and grading of levees.

Location

Salinity Reduction and Habitat Restoration

The project area was historically the marshland between the Napa River and Sonoma Creek in the north San Pablo Bay region and is now called the Napa River Unit. The Napa-Sonoma Marsh historically encompassed more than 38,000 acres extending from San Pablo Bay north to the historic limits of the tidal baylands and east to west between the Napa River and Tolay Creek. Of the 38,000 acres, 25,000 acres of the marshlands were in the Napa River watershed.

Today, approximately 36% of this acreage remains classified as wetland habitat, while 25% consists of inactive solar salt production ponds, 12% residential areas, and 20% cropland and pasture; the remaining 7% has miscellaneous uses. The salt ponds, cropland, and pasture are diked to prevent tidal and fluvial inundation under normal conditions. A majority of the remaining wetland areas are public lands and are under the management of DFG as part of the NSMWA.

Water Delivery Pipelines

The pipelines proposed under the Water Delivery Project Component of the Water Delivery Option would carry water from the SVCSD,NSD, and CAC WWTPs to the Napa River Salt Marsh Restoration Project site (Figure 2). Much of the pipeline alignment would follow the rights-of-way of existing railroad lines or public roads.

Dredged or Fill Material

General Characteristics

Levee maintenance associated with salinity reduction would require adding soil to the existing salt pond levees through either importing material or excavating the internal borrow ditch in each of the ponds. Limited dredging may be required to allow access for the barges associated with the levee repair work, as well as for the barges delivering materials and equipment to install the water control structures.

Marsh restoration under the habitat restoration effort would include some activities to accelerate marsh evolution. These components are as follows:

- **Breaches and Ditch Blocks.** A total of 23 breaches and 22 ditch blocks would enhance tidal circulation in and sediment supply to the ponds.
- **Length of Starter Channels.** The length of starter channels would be approximately 27,500 feet.
- **Increase in the Amount of Levee Lowering.** The total length of levee lowering not associated with ditch blocks would be 22,200 linear feet. This effort would further increase the acreage that would be immediately suitable for marsh vegetation establishment.

Quantity

For the salinity reduction effort, at least two rounds of material placement would be required for the northeastern section of Pond 2 because of its deteriorated condition. Final quantities have not yet been determined.

The placement of fill would be from existing on-site sources and would occur as a result of levee grading and starter channel construction.

Source

The material excavated during levee maintenance associated with salinity reduction would be placed at the sides and tops of the levees, with specific locations, soil heights, and slopes to be determined by a geotechnical engineer. Material used for levee repairs would most likely come from the internal borrow ditches adjacent to levee breaches.

Local on-site material would be used for the habitat restoration effort. Materials excavated for the starter channels would be sidecast and materials moved from the levees would be graded to allow for tidal inundation.

Excavation and Replacement Sites

Location

See "Source" under "Dredged or Fill Material" above.

Size

The total area required for excavation is less than 30 acres. Approximately 15 acres would be associated with levee work and 15 acres would be associated with channel excavation.

Confined, Unconfined, Open Water

For salinity reduction, excavation and replacement would affect confined water in borrow ditch locations internal to the salt ponds and unconfined water for the installation of the infalls and outfalls on the Napa River and Napa Slough.

Habitat

The available construction time would limited by final construction dates specified by the biological opinion. In general, these periods would include protection periods established for endangered species. To minimize impacts on wildlife and habitat from construction-related disruptions, excavation for all ponds would be conducted at the same time.

Timing and Duration of Discharge

Levee maintenance under salinity reduction would take place on an ongoing basis. The placement of fill would take place before levee breaching to minimize in-water construction. The construction period would occur several months each year.

Excavation and Replacement Method

As part of construction of the salinity reduction component, material to reinforce the levees would be excavated from the existing borrow ditches using a long-reach excavator. As it completes repairs, the excavator would move forward along the top of the levee or on barge if needed. Limited dredging may be required to allow access for the barges associated with the levee repair work, as well as for the barges delivering materials and equipment to install the water control structures.

Factual Determinations

Physical Substrate Determinations

Substrate Elevation and Slope

The subtidal and tidal habitat that borders San Pablo Bay receives substantially greater freshwater input than marshes bordering San Francisco Bay to the south; consequently, the habitats tend to be more brackish than salt marshes elsewhere in the San Francisco Bay area. The project area includes 7,190 acres of salt ponds and levees and 2,266 acres of fringing marsh and sloughs. Vegetation communities in the project area include tidal marsh, restored salt pond, abandoned salt pond, and levees. Tidal marsh communities are segregated into three elevation zones: lower tidal marsh (between mean sea level and mean high water [MHW] [3.3–5.5 feet National Annual Vertical Datum (NAVD) 88]), middle tidal marsh (between MHW and MHHW [5.5–6.0 feet NAVD 88]), and upper tidal marsh (from MHHW and up several feet [more than 6.0 feet NAVD 88]). The lower portions of the levees support upper tidal marsh species; higher elevations, above tidal influence, support riparian and upland species.

Most pond bottom elevations are below lower tidal marsh, near mean tide level, between 0.8 and 1.3 NAVD.

Habitat restoration would result in a substantial increase in subtidal habitat, intertidal mudflat, and middle marsh over the long term.

Sediment Type

With implementation of the project, the sediment type would be similar to that found in the project area now.

Dredged/Fill Material Movement

There would be a net elevation decrease in the project area. On-site fill would be used to repair levees. For habitat restoration, the intent is to grade the levees so they become suitable for colonization by marsh vegetation.

Physical Effects on Benthos

Construction of the project's water control structures and levee maintenance would require movement of substrate, which could disturb local benthic organisms. However, recolonization of the area by benthic organisms is expected to occur shortly after construction is completed. Moreover, benthic organisms are adapted to changing salinity, as long as the salinity does not increase above annual maximums. Therefore, the project would not have a significant effect on benthic organisms.

Other Effects

As water is brought into the ponds from the various intakes and tidal gates, fish or zooplankton could be entrained into the ponds. See "Aquatic Ecosystem and Organism Determinations" below.

Water Circulation, Fluctuation, and Salinity Determinations

Current Patterns and Water Circulation

There would be no work in any river currents. The Napa River would not have to be dredged as regularly as a result of the project because of an expanded tidal prism. Tidal channels on and adjacent to restored marshlands would be larger after restoration than under existing conditions, increasing the flood conveyance capacity of these channels.

Normal Water Fluctuation

Breaching the levee system would open Ponds 3 and 4/5 to daily tidal flows that would result in periods of time when the ponds are deeper than under existing conditions. To prevent channel erosion and potential damage to adjacent levee systems, the project sponsors would repair unintended levee breaches.

Salinity and Other Water Quality Determinations

The project would not change the clarity, color, odor, or taste of Napa River water. Elevated levels of salinity would occur on a short-term basis, and pH, nutrients, and other parameters are not expected to adversely affect water quality. Water quality standards would be adhered to (see below), these effects are expected to be nominal.

Compliance with Applicable Water Quality Standards

Operation under the project's salinity reduction component could result in an increase in salinity in the Napa River. However, the project would be designed so that the timing of construction and the potential salinity impacts on the Napa River and sloughs resulting from project-related discharges would comply with waste discharge requirements issued by the San Francisco Bay RWQCB and stipulations imposed by the National Marine Fisheries Service (NMFS) and USFWS. Water quality modeling has been conducted to provide specific design criteria necessary to ensure that salinity changes associated with levee breaches do not exceed water quality objectives or adversely impair beneficial uses.

Suspended Particulate/Turbidity Determinations

Expected Changes in Suspended Particles and Turbidity Levels

Construction activities may cause temporary water quality impairment because of discharges to nearby water and/or drainage channels. If allowed to occur when sensitive organisms are present, discharges of soils and associated contaminants can cause adverse changes in turbidity, aquatic habitat sedimentation, or exposure to toxic substances. The extent of potential environmental impacts depends on the erodibility of soil types encountered, types of construction practices, extent of disturbed area, duration of construction activities, timing of precipitation, and proximity to drainage channels. However, the project sponsors would obtain authorization from the San Francisco Bay RWQCB under waste discharge requirements to construct proposed elements of the project. The project sponsors would prepare a stormwater pollution prevention plan (SWPPP) and require all construction contractors to implement best management practices

(BMPs) identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants.

Short-term channel incision would likely result in increased sediment suspension and water turbidity downstream of areas where erosion is taking place. However, appropriate site-specific design should ensure that this effect would be comparatively minor and that it would decrease and disappear as the system equilibrates as part of habitat restoration.

Effects (Degree and Duration) on Chemical and Physical Properties of the Water Column

The flushing of conventional physical and chemical constituents from the salt ponds during salinity reduction could temporarily degrade water quality in the lower Napa River and sloughs. Specific modeling of fate and transport characteristics of these constituents during salinity reduction operations has not been conducted. In general, the concentration differences of conventional constituents between the ponds and background receiving water are relatively low compared to the difference in salinity between the ponds and background receiving water. However, if salinity reduction operations for the upper ponds (i.e., Pond 7) are not controlled, adverse water quality impacts could occur in receiving waters. Therefore, the project would be designed to comply with resource agency permit conditions (see "Compliance with Applicable Water Quality Standards" below).

Compliance with Applicable Water Quality Standards

As described above under "Water Circulation, Fluctuation, and Salinity Determinations" above, water quality objectives set by the San Francisco Bay RWQCB would not be violated. BMPs identified in the SWPPP to be prepared by the project sponsors would be employed to limit turbidity and sediment transport.

In general, the effluent produced by the WWTPs that may consider participating in the Water Delivery Project Component has moderate inorganic mineral content with low suspended solids and turbidity relative to the natural background conditions in the Napa River and San Pablo Bay. The pH values are neutral, and the effluent usually is in compliance with regulatory permit limits. The RWQCB prohibits effluent discharges that exceed the applicable water quality standards if the quantity of receiving water does not provide an initial dilution capacity for the effluent of at least 10:1. An exception is that effluent discharges are allowed in such situations if the effluent is used to create, restore, and/or enhance wetlands. The wetland restoration project must provide a net environmental benefit and the beneficial uses that are established in the wetland must be fully protected. The Napa River Salt Marsh Restoration Project would provide such a benefit and protect the established beneficial uses; therefore, it would comply with RWQCB requirements.

Contaminant Determinations

The results of testing indicate that organic chemicals (including pesticides, polychlorinated biphenyls [PCBs], dioxins, and semivolatile organic compounds) are encountered only rarely in the project area. When detected, they are present in concentrations well below any hazardous materials thresholds.

Conventional construction activities would include transporting construction materials, such as fuels and oils, and the use of heavy machinery. Fuel and other hazardous materials associated with the operation of the machinery would have to be transported through the sloughs for construction activities required on the island ponds (Ponds 3, 4/5, and 6/6A), increasing the potential for accidental releases of these materials into the environment. However, mitigation has been adopted to reduce this impact to a less-than-significant level.

Project construction activities may cause temporary water quality impairment because disturbed and eroded soil, petroleum products, and miscellaneous wastes could be discharged to nearby water and/or drainage channels. Construction during the winter rainfall season could increase the potential for discharges of contaminated stormwater runoff from construction sites; discharge of contaminated stormwater constitutes a violation of the water quality objectives specified in the *Water Quality Control Plan, San Francisco Bay Region.*

However, as mitigation of these effects, and as described under "Suspended Particulate/Turbidity Determinations" above, the project sponsors would prepare a SWPPP and require all construction contractors to implement BMPs identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants. Construction would be limited to the dry weather season to the maximum extent possible.

Terrestrial Ecosystem and Organism Determinations

Short-Term Disturbance

Implementation of the project may result in a temporary reduction in sensitive communities and habitat for special-status plant species. Although nonnative smooth cord grass (*Spartina alternifolia*) could become established, invasive exotic plant species would be monitored and managed to minimize or prevent the establishment of the species in the area. Construction associated with the salinity reduction options may affect soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*), a federally listed plant species, and several federally listed and state listed wildlife species: California clapper rail (*Rallus longirostris obsoletus*), California black rail (*Laterallus jamaicensis*), western snowy plover (*Charadrius alexandruinus nivosus*), northern harrier (*Circus cyaneus*), Caspian tern (*Hydroprogne caspia*), saltmarsh common yellowthroat (*Geothylpis trichas sinuosa*), San Pablo song sparrow (*Melospiza melodia samuelis*), Suisun ornate shrew (*Sorex ornatus sinuosus*), and salt marsh harvest mouse (*Reithrodontomys raviventris*).

However, mitigation has been adopted to reduce these impacts to less-than-significant levels. Wildlife could be exposed to contaminants in soil unearthed during salinity reduction, but BMPs would be implemented to reduce this impact to a less-than-significant level. Reestablishment of tidal connectivity as a result of habitat restoration could expose wildlife to contaminants in sediments and waters from San Pablo Bay and the Napa River; however, this impact would not be significant because the project would substantially increase suitable habitat and increase habitat values.

Pipeline construction under the Water Delivery Project Component could result in a reduction in sensitive vegetation and wildlife species and their habitats, or interfere with movement of wildlife species; biological surveys would be conducted before completion of final plans for design and construction of each project, trenchless construction techniques would be used, and other mitigation measures would be implemented to reduce this impact to a less-than-significant level.

Long-Term Benefit

The project would result in a long-term net increase in sensitive communities and habitat for special-status species. The project would also result in a substantial long-term increase in low and middle marsh habitat suitable for special-status wildlife species and an overall increase in the availability and quality of marsh fringe aquatic habitats.

Aquatic Ecosystem and Organism Determinations

Short-Term Disturbance

Salinity reduction could result in entrainment of fish and other aquatic organisms in the ponds, and they could be subjected to detrimental water quality conditions and predation by nonnative species. Fish that could be affected include delta smelt (*Hypomesus transpacificus*), splittail (*Pogonichthys macrolepidotus*), steelhead (*Oncorhynchus mykiss*), winter-run and spring-run chinook salmon Evolutionarily Significant Units (*Oncorhynchus tshawytscha*), green sturgeon (*Acipenser medirostris*), and longfin smelt (*Spirinichus thaleichthys*).

The number of fish entrained and proportion of the species' populations affected are likely small. However, such entrainment would be minimized in a manner consistent with the terms and conditions of take authorization provided under federal and California Endangered Species Act consultation for the project. Construction activities could reduce the suitability of aquatic habitat in the short term, but cofferdams or other barriers would be installed around the in-water portion of the intakes and outfalls to minimize this effect; water control structures would be constructed in the late spring and summer months to avoid sensitive life stages of protected species (e.g., delta smelt larvae); and the salinity of discharges from the upper ponds would be limited to protect against a reduction

in aquatic habitat suitability resulting from deterioration in water quality. Accelerated salinity reduction is preferable if within the annual variation of salinity because the potential for long-term chronic effects is reduced. Trenchless technology would be used under the Water Delivery Project Component to protect fish migration, which could otherwise be affected by pipeline construction.

Long-Term Benefit

The project would result in the reestablishment of natural features, such as cord grass, tule marsh, and shallow and deepwater habitats, which would reactivate and maintain ecological processes that sustain healthy fish, wildlife, and plant populations. There would be a greater variety of slough channel sizes, a large increase in slough habitat, and greater connections among San Pablo Bay, the Napa River, and the tidal salt marsh, which would be beneficial to estuarine fish.

Proposed Disposal Site Determination

The release of saline water from the upper pond and Pond 6 outfalls would comply with waste discharge requirements issued by the San Francisco Bay RWQCB and stipulations imposed by USFWS and NMFS. See also "Compliance with Water Quality Standards" under "Water Circulation, Fluctuation, and Salinity Determinations" above.

Determination of Cumulative Effects on the Terrestrial and Aquatic Ecosystem

Terrestrial

Implementation of the project and other restoration projects in the vicinity may result in a temporary reduction, but a long-term net increase, in sensitive communities and habitat for special-status plant species. It is considered unlikely that potential short-term effects from multiple projects would coincide such that the viability of sensitive communities or any one special-status plant species is threatened in the region. Although nonnative smooth cord grass could become established, invasive exotic plant species would be monitored and managed to minimize or prevent the establishment of the species in the area.

In addition, depending on which other restoration/mitigation projects are implemented in the region, there could be either an increase or a decrease in open-water habitat for migratory shorebirds and waterfowl; proposed U.S. Geological Survey (USGS) monitoring of the use of such habitat could provide important direction for future adaptive management decisions.

The project would also result in a long-term increase in lower and middle marsh habitat suitable for special-status wildlife species and an overall increase in the availability and quality of marsh fringe aquatic habitats throughout the San Francisco Bay area. The resulting reestablishment of tidal exchange between restored marshlands and waters of San Pablo Bay and the Napa River is expected to cause the quality of water and sediments within the ponds to become closer to the quality of water in San Pablo Bay and the Napa River; the levels of some constituents are expected to increase and others to decrease.

On a regional level, contaminants may have an adverse effect on biological resources, including reduction in reproductive success at multiple levels of the ecosystem, immune system effects, and overall reduced population viability. However, USGS would continue to monitor conditions at the project site, and the project sponsors would implement an adaptive management plan and contribute to additional mitigation of any regional problems.

Pipeline construction under the Water Delivery Project Component could result in a cumulative reduction in sensitive vegetation and wildlife species and their habitats; biological surveys would be conducted before completion of final plans for design and construction of each project, reducing this impact to a less-than-significant level.

Aquatic

The project in conjunction with other projects could result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Nursery habitat for many species would be greatly enhanced by the implementation of this and other restoration efforts.

Determination of Secondary Effects on the Aquatic Ecosystem

There is a potential for releases of highly saline brines and/or bittern from Pond 7 into the environment. All Pond 7 and 7A levees would be carefully inspected and repaired as necessary to ensure that they would maintain their integrity throughout the desalination period.

Potential Effects on Human Use

Municipal and Private Water Supply

The Water Delivery Project Component would require the involvement of the SVCSD, NSD, and CAC; however, the project would not affect any municipal or private water supply.

Recreational and Commercial Fisheries

Commercial and recreational fisheries would not be adversely affected by the project. As species populations and composition increase, recreational use of the site for fishing is expected to increase.

Water-Related Recreation

Water-related recreational opportunities are expected to improve, thereby increasing public use of the site, as species populations and composition increase as a result of the project. Specifically, recreational use of the site for bird watching, hunting, and fishing is expected to increase. The two duck clubs within the project area would benefit from the project because as habitat quality increases, more waterfowl would be attracted to the site.

Aesthetics

Construction activity associated with the project would temporarily change the visual character of the area; however, it is anticipated that areas disturbed by construction would be returned to preproject conditions or better at the end of the proposed construction activities (e.g., at the end of construction, previously vegetated areas would be reseeded). Visual resources would be beneficially affected by the restoration of habitat; views from State Route 37 would be enhanced with the improvement of habitat quality, and more wildlife would be visible. The project would not create any nighttime glare or impede the quality of the scenic vista.

Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

The project site is located in DFG's Napa River Unit. DFG is one of the project sponsors, and the project is consistent with DFG's use and management of the site. Proposed alignments of the Bay Trail are located along the northern and eastern periphery of the NSMWA; implementation of the project would not conflict with the Bay Trail. Given the proximity of the Bay Trail, the NSMWA might serve as a destination for Bay Trail users.

Finding of Compliance or Noncompliance with the Restrictions on Discharge for the Napa River Salt Marsh Restoration Project

Finding 1

The Section 404(b)(1) Guidelines were not substantially adapted relative to this evaluation.

Finding 2

The Napa River Salt Marsh Restoration Project is the result of extensive planning and screening of potential options. The long-term goal of the project is to produce a natural, self-sustaining habitat that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention. This goal would be met by designing and engineering a restoration project that would both reduce salinity in existing salt ponds and restore tidal marsh in a way that would maximize wildlife habitat diversity. The proposed discharge has been designed to maximize beneficial environmental effects and in effect increase the amount of aquatic habitat on the site compared to existing conditions. Because the proposed discharge would not result in a net adverse impact on the aquatic habitat (in fact, the acreage of habitat would increase substantially), implementation of the project would result in a less adverse impact on the aquatic ecosystem than the No-Project Alternative.

Finding 3

The Napa River Salt Marsh Restoration Project would not violate applicable state water quality standards. To minimize adverse effects, the project would be designed in compliance with resource agency requirements; in addition, comprehensive water quality monitoring would be conducted to protect the aquatic resources of the Napa River and sloughs.

Finding 4

The restoration project would not violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act.

Finding 5

In general, long-term impacts of the salinity reduction and habitat restoration on endangered species and their habitats would be beneficial. Construction associated with the salinity reduction component may affect several federally listed and state-listed plant and wildlife species. However, mitigation has been adopted to reduce these impacts to less-than-significant levels.

Finding 6

The proposed project would not violate any requirement imposed by the Secretary of Commerce to protect marine sanctuaries designated under Title III of the Marine Protection, Research, and Sanctuaries Act of 1972. Ocean dumping of bittern from Pond 7 was ruled out because of the cost and environmental effects of such an option. All materials dredged during project operations would be disposed of at environmentally appropriate sites.

Finding 7

Implementation of the Water Delivery Project Component for the restoration project could result in significant impacts on vegetation and wildlife species federally or state-listed or proposed as endangered, and on other sensitive species. Focused surveys for special-status species protection would be completed before construction, and other mitigation measures would be implemented if these species are present. These impacts are expected to be reduced to a less-than-significant level.

Finding 8

The Napa River Salt Marsh Restoration Project would not result in significant adverse impacts on human health and welfare, including effects on municipal and private water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites; on life stages of aquatic life and other wildlife dependent on aquatic ecosystems; on aquatic ecosystem diversity, productivity, or stability; or on recreational, aesthetic, or economic values. Therefore, the project would not cause or contribute to significant degradation of waters of the United States.

Finding 9

As a habitat restoration project, the Napa River Salt Marsh Restoration Project would result in a long-term benefit to aquatic ecosystems. Adverse impacts could result in the short term from construction of the salinity reduction and water delivery components of the project. However, mitigation measures would

be implemented to reduce these impacts to less-than-significant levels. These measures include installing cofferdams or other barriers and accelerating salinity reduction to decrease long-term water quality effects.

Finding 10

The proposed site for the discharge of dredged and fill material for the Napa River Salt Marsh Restoration Project complies with the Section 404(b)(1) Guidelines.

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Appendix C
Contaminants Toxic to Wildlife

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Contaminants Toxic to Wildlife

This appendix provides additional information on the sources of critical contaminants and associated data supporting the link between contaminants and adverse biological effects.

Arsenic

Arsenic occurs in nature in various forms, including inorganic and organic compounds and trivalent and pentavalent states (Eisler 1988). Trivalent arsenic is considerably more toxic than pentavalent arsenic (Clark 2001). Most living organisms normally contain measurable concentrations of arsenic. In some marine organisms normal arsenic concentrations, except for marine species may exceed 100 milligrams per kilogram (mg/kg) dry weight, usually as arsenobetaine. Arsenobetaine, a water-soluble pentavalent organoarsenical, is very stable, metabolically inert, and nontoxic and thus poses little toxicological risk to the organism or its consumers. A variety of marine organisms, including algae, crustaceans, and fish, bioaccumulate arsenic, but arsenic does not biomagnify through food chains (Clark 2001).

Adverse effects on estuarine and marine organisms have been reported at water concentration levels of 100 micrograms per liter (μg/l) and above. The 96-hour concentration lethal to 50% of an exposed test population (LC_{50}) of arsenic trioxide for larvae of the Dungeness crab (*Cancer magister*) is 232 μg/l; the 48-hour LC_{50} of sodium arsenite for abnormal development in the Pacific oyster (*Crassostrea gigas*) is 326 μg/l. Studies of benthic fauna in Puget Sound where sediments are contaminated with more than 57 mg/kg arsenic (dry weight) have shown significant reductions in the abundance of polychaetes, mollusks, and crustaceans. Toxic effects have also been reported in marine benthos in heavily contaminated areas of San Francisco Bay where sediment concentrations were measured at 50–60 mg/kg (dry weight) (Clark 2001).

Chromium

Chromium is widespread in the environment, occurring naturally in air, rocks, soil, and water. Anthropogenic sources include industrial production of stainless

steel; electroplating of chrome; use of dyes; leather tanning; and use of wood preservatives.

Chromium occurs in several forms or oxidation states, primarily hexavalent (chromium^{VI}) and trivalent (chromium^{III}). It is a micronutrient but is toxic at high concentrations. Adverse effects are substantially influenced by a variety of biotic and abiotic factors, including the species, age, and developmental stage of the organism; the temperature, pH, salinity, and alkalinity of the medium; the effects of interactions between chromium and other contaminants; and the duration of exposure and the chemical form of chromium involved. For chromium^{VI}, the 96-hour LC_{50} values for marine species range from 445 to 2,000 parts per billion (ppb) (Note: 1 ppb = 1 microgram per kilogram [μg/kg]). For chromium^{III}, the 96-hour LC_{50} values for marine species are 3,300–7,500 ppb. Studies of chickens (*Gallus domesticus*) fed 100 ppm chromium^{VI} for 32 days showed no adverse effects on survival, growth, or feeding capacity (Rosomer et al. 1961).

Copper

Copper is an essential element for many animals, especially marine decapod crustaceans, gastropods, and cephalopods, all of which use haemocyanin, a respiratory pigment that contains copper (Clark 2001). In these species, copper is usually stored in the liver, often at very high concentrations. It has been recorded in the liver of *Octopus vulgaris* at 4,800 parts per million (ppm) and 2,000 ppm in the hepatopancreas of the lobster (*Homarus gammarus*) (Note: 1 ppb = 1 microgram per kilogram [μ/gl]). The blood cells of oysters may contain up to 20,000 ppm copper. Despite these high concentrations in the tissues of some species, copper is highly toxic to many forms of marine invertebrates; as a result, it has historically been used as an antifouling agent for ships. The 96-hour LC_{50} for mollusks and crustaceans is 28–39 μg/l, with sublethal effects occurring at 1–10 μg/l. In fish, behavior, growth, migration, and metabolism can be adversely impaired at levels of 4–10 μg/l for sensitive species (Eisler 1998). The early life stages of fish are especially vulnerable (Luoma et al. 1998).

The assessment of effects of copper contamination on organisms in nature is difficult, in part because it is difficult to isolate the effects of copper from those of other contaminants, and also because it is not well understood how toxic effects at one trophic level affect processes at other trophic levels. Moreover, direct evidence of bioaccumulation is not proof of toxicity (Hornberger et al. 1999).

Long-term studies of marine organisms exposed to chronic copper contamination have shown that natural detoxifying mechanisms may allow them to adapt, survive, and actually thrive under conditions lethal to other unexposed populations. For example, in Restronguet Creek in southwest England, copper contamination of sediments reaches 2,148 ppm, but the flora and fauna of the area are unexpectedly normal (Clark 2001). However, not all systems exposed to copper contamination show the same resilience. More locally, a long-term study

of contamination in a mudflat in Palo Alto showed extractable copper levels of 30–60 mg/kg (i.e., 30–60 ppm) and tissue concentrations in the resident clam *Macoma baltica* ranging from 100 to 300 μg/kg (0.01–0.03 ppm) (Luoma 1995). Adverse effects on the clam were indicated by reproductive anomalies, including a reduction in the percentage of reproductive clams and an inordinately high percentage of males in the population. Nonetheless, the clam population in this area was shown to be 6 times more resistant to the effects of copper contamination than populations at uncontaminated sites.

Mercury

Mercury contamination is widespread in sediments and waters of the San Francisco Bay area. Elevated mercury levels are in large part a legacy of the California gold-mining era, when mercury was used in the gold-refining process. Mines such as the south bay's New Almaden Mine, which operated for many years in the upper Guadalupe River watershed extracting the mercury ore cinnabar, are known to be a source of mercury in the bay and its tributaries. Over time, leaching of mine tailings and overland transport of mercury-bearing sediments have resulted in the downstream accumulation of mercury in the watershed (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). Mercury is also delivered to the bay via the Sacramento–San Joaquin Delta (Delta).

In aquatic environments, most mercury is chemically bound to suspended particles of soil or sediment; a smaller fraction is bound to dissolved organic carbon. Sediment-bound mercury may be available to aquatic organisms, and is thus a pollutant of concern; the potential for adverse environmental effects from sediment-bound mercury depends primarily on transport and depositional characteristics (e.g., particle size), and on the physical and chemical properties of the sediment. Additionally, sediment-bound mercury may be converted through both biotic and abiotic processes to its more bioavailable methylated form. Factors conducive to methylation of mercury include low-flow or stagnant waters, hypoxic or anoxic conditions in the water or sediment column, low pH (pH<6), and high concentrations of dissolved carbon. Most of these factors are in turn affected by biological processes such as metabolism, growth, and decay; for example, mercury methylation has been linked to the activity of sulfate-reducing bacteria in the shallow anoxic sediment column (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001).

Methyl mercury is readily adsorbed by aquatic plants, fish, and wildlife. It has been demonstrated to accumulate in their tissues and to transfer through the food web as contaminated food sources (plant or animal tissues) are consumed (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). It has a variety of toxic effects, including birth defects, embryotoxicity, carcinogenicity, and neurotoxicity. In aquatic organisms, concentrations of 0.1–200 μg/l have been shown to produce adverse effects; toxicity increases with age of the organism, exposure time, temperature, lowered salinities, and the presence of other metals.

Mercury levels and uptake rates in exposed plants and wildlife depend on the source and type of mercury to which the organisms are exposed and on the structure of the local food web (i.e., the uptake pathway). Both terrestrial and aquatic plants take up inorganic and methyl mercury from water, sediment, and the atmosphere. Uptake rate varies by species, but mercury uptake is typically higher in aquatic plants than in terrestrial plants because methyl mercury in particular is more readily taken up from water than from sediment. Aquatic organisms at lower trophic levels (e.g., algae, phytoplankton, filter-feeding invertebrates) take up mercury predominantly from dissolved concentrations in the water column. Species at higher trophic levels (such as fish) accumulate mercury from two sources: bioaccumulation from the tissues of organisms they consume and direct adsorption from the water column (Hill et al. 1996).

Fish may bioaccumulate methyl mercury by a factor of approximately 100,000 (Gilmour and Henry 1991). Mercury concentrations in fish vary by species because of differences in diet, metabolic rate, and growth rate. Fish in oceanic waters may contain as much as 150 µg/kg (0.015 ppm) mercury in muscle tissue (Eisler 1987). In general, larger, older fish have higher mercury concentrations, partly because their prey consists of larger species from higher trophic levels. Piscivorous fishes also tend to have higher mercury concentrations than species that feed primarily on algae or invertebrates (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). Mercury is known to interfere with fish reproduction, and mercury tissue levels of 5–7 mg/kg (5–7 ppm) have been shown to be lethal (Eisler 1987).

Mercury concentrations in other species at higher trophic levels, including birds and other wildlife, are also directly correlated with diet. Factors influencing mercury levels include species-specific sensitivity, foraging area, size of fish or other prey consumed, and the percentages of fish and other food sources in the diet. Because mercury is concentrated in the muscle tissue of exposed fish, birds such as the black-crowned night heron (*Nycticorax nycticorax*), common merganser (*Mergus merganser*), cormorant (*Phalacrocorax* sp.), and belted kingfisher (*Ceryle alcyon*) that prey on fish tend to bioaccumulate more mercury than species that feed on a greater variety of foods. Species such as the clapper rail (*Rallus longirostris obsoletus*) that consume primarily invertebrates are also likely to be vulnerable to bioaccumulation of methyl mercury in the food web.

Most of the body concentration of mercury in piscivorous birds is stored in the plumage (Clark 2001). Virtually all of it is in the methylated form and is shed when the birds molt. As much as 50% of the remaining body burden of mercury is transferred to the growing feathers following molt; the plumage thus provides an important elimination pathway for methyl mercury in many birds.

The eggs of seabirds, including species of gulls, are also tolerant to mercury contamination. Whereas reproductive dysfunction has been observed in mallards (*Anas platyrhynchos*) with eggs containing 6–9 µg/g (6–9 ppm) mercury, no effects on hatching or fledging occur in eggs of herring gulls (*Larus argentatus*) contaminated with up to 16 µg/g (16 ppm) mercury.

Mercury has been shown to produce a variety of toxic and teratogenic effects in humans; the forms of mercury that pose the greatest risk for human toxicity are elemental mercury and methyl mercury. Consumption of contaminated food sources, particularly fish, is a common exposure pathway for human toxicity; consumption of some fish caught in San Francisco Bay and the Delta has been specifically identified as a human health risk (Office of Environmental Health Hazard Assessment 2001). In addition, based on concerns regarding human and environmental toxicity, the U.S. Environmental Protection Agency (EPA) classifies soils and sediments that contain more than more than 20 mg/kg total mercury as hazardous waste; 23 mg/kg total mercury represents EPA's preliminary remediation goal for mercury (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001); bay and tributary sediments may locally meet or exceed these thresholds.

Nickel

Nickel is a heavy metal that can be a significant contaminant in estuarine sediments of industrialized areas. In relatively uncontaminated areas, typical concentrations of dissolved nickel are 0.2 µg/l (0.2 ppb) in the open ocean and 14–30 µg/g (14–30 ppm) in sediments.

Nickel is regarded as only moderately toxic by comparison with other metals such as mercury, and there is no evidence that nickel is bioaccumulated or biomagnified in marine food webs (Clark 2001). Nickel toxicity varies widely with organism and environmental condition and is particularly influenced by salinity and the presence of other ions. Toxicity ranges for the 96-hour LC_{50} include 17 ppm to more than 50 ppm for polychaetes, 1,150 ppb (0.115 ppm) to 47 ppm for crustaceans, 60–320 ppm for mollusks, 30–70 ppm for estuarine fish, and 8–350 ppm for marine fish (Clark 2001). The benthic species diversity of highly industrialized areas (e.g., Massachusetts Bay, Puget Sound, and Los Angeles Harbor) has been shown to be reduced in areas where nickel concentrations in sediments reach levels of 20–30 µg/g (20–30 ppm) (Clark 2001).

Polycyclic Aromatic Hydrocarbons

There are thousands of polycyclic aromatic hydrocarbon (PAH) compounds, each consisting of hydrogen and carbon arranged in the form of two or more fused benzene rings. PAH compounds differ in the number and position of aromatic rings and in the position of substituents on the basic ring system. Environmental concern has focused on 2-ring (naphthalene) to 7-ring (coronene) structures. Unsubstituted 2–3-ring PAHs exhibit significant toxicity, but are noncarcinogenic; 4–7-ring PAHs are significantly less toxic, but are demonstrably carcinogenic, mutagenic, or teratogenic to a large variety of organisms, including fish and birds.

In general, PAHs show little tendency to biomagnify in food chains, primarily because they are rapidly metabolized. Accumulation in aquatic organisms is largely related to the ability to metabolize the compounds. Species at lower trophic levels, such as plankton and mollusks, are unable to effectively metabolize and excrete the compounds, which therefore accumulate in their tissues. Organisms at higher trophic levels, including fish and crustaceans, only accumulate PAHs in highly contaminated areas.

Toxicity levels for larval and juvenile fish may be as low as 0.1–5 μg/l for sublethal effects (National Oceanic and Atmospheric Administration 1999). A wide variety of adverse biological effects linked with PAH contamination have been reported in numerous species of organisms under laboratory conditions. These include the formation of tumors, as well as effects on survival, growth, and metabolism. Responses to carcinogenic PAHs are quite variable between species, and can be significantly modified by many chemicals, including other PAHs. These complexities render attempts at extrapolating laboratory results to field situations extremely difficult and unreliable.

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) have been linked with a variety of adverse effects in aquatic organisms, including birth defects, reproductive failure, liver damage, mutation, carcinogenicity, wasting syndrome, and death. PCBs both bioaccumulate and biomagnify in natural food chains; bioconcentration from water has been documented at a factor of 10,000 to 100,000. The most significant levels of PCBs and the greatest potential for adverse effects on estuarine organisms are therefore likely to occur at higher trophic levels, primarily in invertebrate- and fish-eating birds (Zaranke et al. 1997). Fish-eating birds such as cormorants have been found to accumulate PCBs to high levels in their tissues with consequential adverse effects including reproductive failure, kidney/liver/heart damage, tremors, beak deterioration, loss of muscle coordination, behavior alterations, and eggshell thinning. Comparable effects are likely to occur in other birds that forage largely on marine invertebrates such as rails and various species of short-and long-legged waders. Because PCBs bind to particulate material and do not release directly into the water column, their bioavailability is linked to the level of organic matter and suspended sediment in the water column.

Chlorinated Hydrocarbons

Chlorinated hydrocarbons such as dichlorodiphenyltrichloroethane (DDT) are highly insoluble in water, with an aqueous saturation concentration of less than 1 ppb, but they are soluble in fats and may adsorb to particles. The distribution and bioavailability of these compounds in estuarine systems is largely associated with the presence of suspended sediments and microorganisms such as diatoms. Thus, filter-feeding organisms that directly or indirectly ingest sediment particles and

microorganisms, and organisms that prey on these first-order consumers, therefore form a primary route for accumulation and transfer of DDTs in both marine and terrestrial food chains. Because DDTs are difficult to excrete and are lipid-soluble, they tend to accumulate and concentrate in the fatty tissues of receptor organisms, leading to bioaccumulation and biomagnification through the food web.

Because organochlorines are stored in fatty tissues, they become biologically available and physiologically active only when fat tissues are metabolized. Receptors may therefore acquire considerable body burden of DDTs but show no ill effects except during conditions of starvation, when fat reserves are mobilized. Accordingly, it is difficult to be precise about the potential effect of these contaminants based on tissue concentrations only.

The highest concentration factors for DDT (~70,000) have been documented in bivalve mollusks such as oysters and clams. Accumulation factors for crustaceans and fish range from 100 to 10,000; those for seabirds are less than 10. Laboratory studies of phytoplankton show that DDT can reduce primary production as much as 50% at concentrations of only 1 μg/l (1 ppb). The 96-hour LC_{50} values for shrimp, including *Cragon* sp. and *Palaemonetes* sp., are 6–60 μg/l for DDT. Marine fish also appear to be very sensitive to a number of organochlorines, including DDT; the 96-hour LC_{50} for marine fish ranges from 0.4 μg/l to 89 μg/l.

Very large doses of DDT (on the order of several grams per kilogram of body weight) are required to cause death in birds and mammals. One critical sublethal effect of DDT and its residues on birds is interference with calcium metabolism, resulting in thinning of eggshells. During its use as a pesticide, bioaccumulation of DDT led to significant population declines of several top-level avian predator species, including peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and brown pelican (*Pelecanus occidentalis*) (Anderson et al. 1975, Garcelon et al. 1989, Clark 2001). Contamination by DDTs has also been historically linked with reproductive problems in several predatory marine animals in California, including premature pupping in California sea lions (*Zalophus californianus californianus*) (DeLong et al. 1973, Gilmartin et al. 1976).

Tributylin

Tributylin (TBT) is an organotin biocide used in ship antifoulant paints. Like PCBs, pesticides, and a variety of other organic contaminants, TBTs are known to have adverse effects on marine life; as endocrine inhibitors, TBTs interfere with the normal hormonal processes of receptor organisms. They have been found to cause deformation in oysters and sex changes in whelks, and are also widely believed to cause immune suppression and increased susceptibility to lethal diseases in seals, sea lions, and sea otters (see Kannan et al. 1999, Nakata et al. 1998, Kajiwara et al. 2001).

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Appendix D

Species that May Occur in the Project Area or Be Affected by the Project

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

IN REPLY REFER TO:
1-1-02-SP-1906

May 15, 2002

Mr. Roderick A. Chisholm, II
Chief, Environmental Section
(Attn.: Bill DeJager)
U.S. Army Corps of Engineers
San Francisco District
333 Market Street
San Francisco, California 94105-2197

Subject: Species List for Feasibility Study of Ecosystem Restoration Alternatives for the Salt Ponds along the Napa River, Napa and Solano Counties, California

Dear Mr. Chisholm:

We are sending the enclosed list in response to your May 9, 2002, request for information about endangered and threatened species (Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service (Service) to provide species lists under section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The animal species on the Enclosure A quad list are those species we believe may occur within, *or be affected by projects within*, the following USGS quads, where your project is planned: Cuttings Wharf, Sears Point and Sonoma Quads.

Any plants on the quad list are ones *that have actually been observed* in the project quad(s). Plants may occur in a quad without having been observed there. Therefore we have included a species list for the whole county in which your project occurs. We recommend that you survey for any relevant plants shown on this list.

Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them. Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.

Executive Order 13186, January 17, 2001, directs Federal agencies to take specific steps to conserve migratory birds. *Species of Concern* (see below) are specifically included in this

Executive Order. The Order can be found at www.nara.gov/fedreg/eo.html) Birds are shown on our species lists regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

If a species has been listed as threatened or endangered by the State of California, but not by us nor by the National Marine Fisheries Service, it will appear on your list as a Species of Concern.

However you must contact the California Department of Fish and Game for official information about these species. Call (916) 322-2493 or write Marketing Manager, California Department of Fish and Game, Natural Diversity Data Base, 1416 Ninth Street, Sacramento, California 95814.

Some of the species listed in Enclosure A may not be affected by the proposed action. A trained biologist or botanist, familiar with the habitat requirements of the listed species, should determine whether these species or habitats suitable for them may be affected. For plants, we recommend using the enclosed Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species (Enclosure C).

Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is available upon request. This information may be helpful in preparing the biological assessment for this project, if one is required. Please see Enclosure B for a discussion of the responsibilities Federal agencies have under section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal agency or its designated non-Federal representative.

Formal consultation, under 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office under 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as *critical habitat*. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal. Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, this will be noted on the species list. Maps and boundary descriptions of the critical habitat may be found in the *Federal Register*. The information is also reprinted in the *Code of Federal Regulations* (50 **CFR** 17.95).

Candidate species are being reviewed for possible listing. Contact our office if your biological assessment reveals any candidate species that might be adversely affected. Although they currently have no protection under the Endangered Species Act, one or more of them could be proposed and listed before your project is completed. By considering them from the beginning, you could avoid problems later.

Your list may contain a section called *Species of Concern*. This term includes former *category 2 candidate species* and other plants and animals of concern to the Service and other Federal, State and private conservation agencies and organizations. Some of these species may become candidate species in the future.

Please contact Dan Buford, Branch Chief, at (916) 414-6625, if you have any questions about the attached list or your responsibilities under the Endangered Species Act. For the fastest response to species list requests, address them to the attention of Species Lists at this address. You may fax requests to 414-6712 or 414-6713. You may also email them to harry_mossman@fws.gov.

Sincerely,

Michael G. Vaughn [signature]
for

Jan C. Knight
Chief, Endangered Species Division

Enclosures

ENCLOSURE A

Endangered and Threatened Species that May Occur in or be Affected by

Projects in the Area of the Following California Counties

Reference File No. 1-1-02-SP-1906

May 15, 2002

NAPA COUNTY

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

bald eagle, *Haliaeetus leucocephalus* (T)

northern spotted owl, *Strix occidentalis caurina* (T)

western snowy plover, *Charadrius alexandrinus nivosus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Critical habitat, Central California coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

delta smelt, *Hypomesus transpacificus* (T)

tidewater goby, *Eucyclogobius newberryi* (E)

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Conservancy fairy shrimp, *Branchinecta conservatio* (E)

callippe silverspot butterfly, *Speyeria callippe callippe* (E)

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

Plants

Calistoga allocarya (popcorn-flower), *Plagiobothrys strictus* (E)

Clara Hunt's milk-vetch, *Astragalus clarianus* (E)
Contra Costa goldfields, *Lasthenia conjugens* (E)
Napa bluegrass, *Poa napensis* (E)
Sebastopol meadowfoam, *Limnanthes vinculans* (E)
Tiburon paintbrush, *Castilleja affinis ssp. neglecta* (E)
few-flowered navarretia, *Navarretia leucocephala ssp. pauciflora* (E)
showy Indian clover, *Trifolium amoenum* (E) *
soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E)

Proposed Species

Birds

mountain plover, *Charadrius montanus* (PT)

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *

Amphibians

California tiger salamander, *Ambystoma californiense* (C)

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)
San Joaquin pocket mouse, *Perognathus inornatus* (SC)
Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
long-legged myotis bat, *Myotis volans* (SC)

Birds

Allen's hummingbird, *Selasphorus sasin* (SC)
American bittern, *Botaurus lentiginosus* (SC)
American peregrine falcon, *Falco peregrinus anatum* (D)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
California thrasher, *Toxostoma redivivum* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
Snowy Egret, *Egretta thula* (MB)
Vaux's swift, *Chaetura vauxi* (SC)

black rail, *Laterallus jamaicensis coturniculus* (CA)
common loon, *Gavia immer* (SC)
ferruginous hawk, *Buteo regalis* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
loggerhead shrike, *Lanius ludovicianus* (SC)
long-billed curlew, *Numenius americanus* (SC)
oak titmouse, *Baeolophus inornatus* (SLC)
olive-sided flycatcher, *Contopus cooperi* (SC)
rufous hummingbird, *Selasphorus rufus* (SC)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
short-eared owl, *Asio flammeus* (SC)
tricolored blackbird, *Agelaius tricolor* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
white-faced ibis, *Plegadis chihi* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

Reptiles

California horned lizard, *Phrynosoma coronatum frontale* (SC)
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Spea hammondii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)
green sturgeon, *Acipenser medirostris* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)
river lamprey, *Lampetra ayresi* (SC)

Invertebrates

California linderiella fairy shrimp, *Linderiella occidentalis* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)
Sonoma arctic skipper, *Carterocephalus palaemon ssp.* (SC)

Plants

Baker's narvarretia, *Navarretia leucocephala ssp. bakeri* (SC)
Brewer's dwarf-flax (=western flax), *Hesperolinon breweri* (SC)
Calistoga ceanothus, *Ceanothus divergens* (SC)
Colusa layia (=Colusa tidytips), *Layia septentrionalis* (SLC)
Contact (Socrates) Mine jewelflower, *Streptanthus brachiatus ssp. brachiatus* (SC)

Gairdner's yampah, *Perideridia gairdneri ssp. gairdneri* (SC)
Hall's madia (=Hall's harmonia), *Madia hallii (=Harmonia hallii)* (SC)
Jepson's linanthus, *Linanthus jepsonii* (SLC)
Jepson's milk-vetch, *Astragalus rattanii var jepsonianus* (SLC)
Kruckeberg's jewelflower, *Streptanthus morrisonii ssp. kruckebergii* (SC)
Marin County navarretia (=San Anselmo navarretia), *Navarretia rosulata* (SLC)
Marin checkermallow (=checkerbloom), *Sidalcea hickmanii ssp. viridis* (SLC)
Marin knotweed, *Polygonum marinense* (SLC)
Mason's lilaeopsis, *Lilaeopsis masonii* (SC)
Mt. Saint Helena morning-glory, *Calystegia collina ssp. oxyphylla* (SLC)
Napa false indigo, *Amorpha californica var. napensis* (SLC)
Napa western flax, *Hesperolinon serpentinum* (SC)
Northern California black walnut, *Juglans californica var. hindsii* (SC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)
Rincon Ridge ceanothus, *Ceanothus confusus* (SC)
San Joaquin spearscale (=saltbush), *Atriplex joaquiniana* (SC)
Snow Mountain buckwheat, *Eriogonum nervulosum* (SC)
Sonoma ceanothus, *Ceanothus sonomensis* (SC)
St. Helena fawn lily, *Erythronium helenae* (SLC)
Suisun Marsh aster, *Aster lentus* (SC)
Three Peaks jewelflower, *Streptanthus morrisonii ssp. elatus* (SC)
Tiburon buckwheat, *Eriogonum caninum* (SLC)
Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)
adobe lily, *Fritillaria pluriflora* (SC)
alkali milk-vetch, *Astragalus tener var. tener* (SC)
bent-flowered fiddleneck, *Amsinckia lunaris* (SLC)
big-scale (=California) balsamroot, *Balsamorhiza macrolepis var macrolepis* (SLC)
delta tule-pea, *Lathyrus jepsonii var. jepsonii* (SC)
drymaria dwarf-flax (=western flax), *Hesperolinon drymarioides* (SC)
green (=serpentine) jewel-flower, *Streptanthus breweri var hesperidis (=S. hesperidi)* (SLC)
holly-leaved ceanothus, *Ceanothus purpureus* (SLC)
legenere, *Legenere limosa* (SC)
narrow-anthered California brodiaea, *Brodiaea californica var leptandra* (SLC)
narrow-leaved daisy (=serpentine fleabane), *Erigeron angustatus* (SLC)
pink creamsacs, *Castilleja rubicundula ssp. rubicundula* (SLC)
robust monardella (=robust coyote mint), *Monardella villosa ssp globosa* (SLC)
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
serpentine (=Cleveland's) cryptantha, *Cryptantha clevelandii* (SLC)
two-carpeled dwarf-flax (=western flax), *Hesperolinon bicarpellatum* (SC)

water sack (=saline) clover, *Trifolim depauperatum var. hydrophilum* (SC)
water-loving checkermallow (=marsh checkerbloom), *Sidalcea oregana ssp. hydrophila* (SC)

SOLANO COUNTY

Listed Species

Mammals

riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia* (E) *
riparian brush rabbit, *Sylvilagus bachmani riparius* (E) *
salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

California brown pelican, *Pelecanus occidentalis californicus* (E)
California clapper rail, *Rallus longirostris obsoletus* (E)
California least tern, *Sterna antillarum (=albifrons) browni* (E)
bald eagle, *Haliaeetus leucocephalus* (T)
western snowy plover, *Charadrius alexandrinus nivosus* (T)

Reptiles

Alameda whipsnake, *Masticophis lateralis euryxanthus* (T)
giant garter snake, *Thamnophis gigas* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Critical habitat, Central California coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical habitat, Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical habitat, delta smelt, *Hypomesus transpacificus* (T)
Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)
coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
delta smelt, *Hypomesus transpacificus* (T)
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Invertebrates

Conservancy fairy shrimp, *Branchinecta conservatio* (E)
Critical habitat, delta green ground beetle, *Elaphrus viridis* (T)
callippe silverspot butterfly, *Speyeria callippe callippe* (E)
delta green ground beetle, *Elaphrus viridis* (T)

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)
vernal pool fairy shrimp, *Branchinecta lynchi* (T)
vernal pool tadpole shrimp, *Lepidurus packardi* (E)

Plants

Colusa grass, *Neostapfia colusana* (T)
Contra Costa goldfields, *Lasthenia conjugens* (E)
Solano grass (=Crampton's tuctoria), *Tuctoria mucronata* (E)
Suisun thistle, *Cirsium hydrophilum var. hydrophilum* (E)
showy Indian clover, *Trifolium amoenum* (E) *
soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E)

Proposed Species

Birds

mountain plover, *Charadrius montanus* (PT)

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *

Amphibians

California tiger salamander, *Ambystoma californiense* (C)

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)
San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (SC)
San Joaquin pocket mouse, *Perognathus inornatus* (SC)
Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
long-legged myotis bat, *Myotis volans* (SC)
small-footed myotis bat, *Myotis ciliolabrum* (SC)

Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (D)
Allen's hummingbird, *Selasphorus sasin* (SC)
American bittern, *Botaurus lentiginosus* (SC)
American peregrine falcon, *Falco peregrinus anatum* (D)

California thrasher, *Toxostoma redivivum* (SC)
Lawrence's goldfinch, *Carduelis lawrencei* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
Snowy Egret, *Egretta thula* (MB)
Suisun song sparrow, *Melospiza melodia maxillaris* (SC)
Swainson's hawk, *Buteo Swainsoni* (CA)
Vaux's swift, *Chaetura vauxi* (SC)
bank swallow, *Riparia riparia* (CA)
black rail, *Laterallus jamaicensis coturniculus* (CA)
common loon, *Gavia immer* (SC)
ferruginous hawk, *Buteo regalis* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
greater sandhill crane, *Grus canadensis tabida* (CA)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
loggerhead shrike, *Lanius ludovicianus* (SC)
long-billed curlew, *Numenius americanus* (SC)
oak titmouse, *Baeolophus inornatus* (SLC)
olive-sided flycatcher, *Contopus cooperi* (SC)
rufous hummingbird, *Selasphorus rufus* (SC)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
short-eared owl, *Asio flammeus* (SC)
tricolored blackbird, *Agelaius tricolor* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
white-faced ibis, *Plegadis chihi* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

Reptiles

California horned lizard, *Phrynosoma coronatum frontale* (SC)
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
silvery legless lizard, *Anniella pulchra pulchra* (SC)
southwestern pond turtle, *Clemmys marmorata pallida* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Spea hammondii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)
green sturgeon, *Acipenser medirostris* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)
river lamprey, *Lampetra ayresi* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)
California linderiella fairy shrimp, *Linderiella occidentalis* (SC)
Midvalley fairy shrimp, *Branchinecta mesovallensis* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)
Sacramento anthicid beetle, *Anthicus sacramento* (SC)
San Francisco lacewing, *Nothochrysa californica* (SC)
San Joaquin dune beetle, *Coelus gracilis* (SC)

Plants

Baker's narvarretia, *Navarretia leucocephala ssp. bakeri* (SC)
Big plant, *Blepharizonia plumosa ssp. plumosa* (SC) *
Boggs Lake hedge-hyssop, *Gratiola heterosepala* (CA)
Brewer's dwarf-flax (=western flax), *Hesperolinon breweri* (SC)
Carquinez goldenbush, *Isocoma arguta* (SC)
Congdon's tarplant, *Hemizonia parryi ssp. congdonii* (SC) *
Ferris's milk-vetch, *Astragalus tener var. ferrisiae* (SC) *
Gairdner's yampah, *Perideridia gairdneri ssp. gairdneri* (SC)
Heckard's pepper-grass (Heckard's pepperweed), *Lepidium latipes var. heckardii* (SLC)
Marin knotweed, *Polygonum marinense* (SLC)
Mason's lilaeopsis, *Lilaeopsis masonii* (SC)
Northern California black walnut, *Juglans californica var. hindsii* (SC) *
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)
San Joaquin spearscale (=saltbush), *Atriplex joaquiniana* (SC)
Suisun Marsh aster, *Aster lentus* (SC)
adobe lily, *Fritillaria pluriflora* (SC)
alkali milk-vetch, *Astragalus tener var. tener* (SC)
bearded allocarya (popcorn-flower), *Plagiobothrys hystriculus* (SC) **
big-scale (=California) balsamroot, *Balsamorhiza macrolepis var macrolepis* (SLC)
brittlescale, *Atriplex depressa* (SC)
delta tule-pea, *Lathyrus jepsonii var. jepsonii* (SC)
fragrant fritillary (= prairie bells), *Fritillaria liliacea* (SC)
heartscale, *Atriplex cordulata* (SC)
hispid bird's-beak, *Cordylanthus mollis ssp. hispidus* (SC)
holly-leaved ceanothus, *Ceanothus purpureus* (SLC)
legenere, *Legenere limosa* (SC)
little mousetail, *Myosurus minimus ssp. apus* (SC)
recurved larkspur, *Delphinium recurvatum* (SC)
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

vernal pool (=persistent-fruited, Sacramento) saltbush (=smallscale, saltscale), *Atriplex persistens* (SC)

water sack (=saline) clover, *Trifolim depauperatum var. hydrophilum* (SC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened
(PX)	*Proposed Critical Habitat*	Proposed as an area essential to the conservation of the species.
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	Other species of concern to the Service.
(SLC)	*Species of Local Concern*	Species of local or regional concern or conservation significance.
(D)	*Delisted*	Delisted. Status to be monitored for 5 years.
(CA)	*State-Listed*	Listed as threatened or endangered by the State of California.
NMFS	NMFS species	Under jurisdiction of the National Marine Fisheries Service. Contact them directly.
*	*Extirpated*	Possibly extirpated from the area.
**	*Extinct*	Possibly extinct
	Critical Habitat	Area essential to the conservation of a species.

ENCLOSURE A

Endangered and Threatened Species that May Occur in
or be Affected by Projects in the Selected Quads Listed Below
Reference File No. 1-1-02-SP-1906
May 15, 2002

QUAD: 483A CUTTINGS WHARF

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

callippe silverspot butterfly, *Speyeria callippe callippe* (E)

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E)

Contra Costa goldfields, *Lasthenia conjugens* (E)

showy Indian clover, *Trifolium amoenum* (E) *

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

black rail, *Laterallus jamaicensis coturniculus* (CA)

Lewis' woodpecker, *Melanerpes lewis* (SC)

San Pablo song sparrow, *Melospiza melodia samuelis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Spea hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

river lamprey, *Lampetra ayresi* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

Suisun Marsh aster, *Aster lentus* (SC)

alkali milk-vetch, *Astragalus tener var. tener* (SC)

San Joaquin spearscale (=saltbush), *Atriplex joaquiniana* (SC)

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

delta tule-pea, *Lathyrus jepsonii var. jepsonii* (SC)

legenere, *Legenere limosa* (SC)

Mason's lilaeopsis, *Lilaeopsis masonii* (SC)

Marin knotweed, *Polygonum marinense* (SLC)

Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

QUAD: 483B SEARS POINT

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Baker's stickyseed, *Blennosperma bakeri* (E)

soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E) *

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Spea hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)
river lamprey, *Lampetra ayresi* (SC)
Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)
water sack (=saline) clover, *Trifolim depauperatum var. hydrophilum* (SC)

QUAD: 500C SONOMA

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

bald eagle, *Haliaeetus leucocephalus* (T)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

delta smelt, *Hypomesus transpacificus* (T)

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Baker's stickyseed, *Blennosperma bakeri* (E)

Sonoma spineflower, *Chorizanthe valida* (E) *

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

oak titmouse, *Baeolophus inornatus* (SLC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

loggerhead shrike, *Lanius ludovicianus* (SC)

Lewis' woodpecker, *Melanerpes lewis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

California thrasher, *Toxostoma redivivum* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Spea hammondii* (SC)

Fish

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

Napa false indigo, *Amorpha californica var. napensis* (SLC)

Baker's manzanita, *Arctostaphylos bakeri ssp. bakeri* (SC)

Sonoma manzanita, *Arctostaphylos canescens ssp sonomensis* (SLC)

narrow-anthered California brodiaea, *Brodiaea californica var leptandra* (SLC)

Sonoma ceanothus, *Ceanothus sonomensis* (SC)

Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened.
(PX)	*Proposed Critical Habitat*	Proposed as an area essential to the conservation of the species.
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(SLC)	*Species of Local Concern*	Species of local or regional concern or conservation significance.
(MB)	*Migratory Bird*	Migratory bird
NMFS	NMFS species	Under the jurisdiction of the National Marine Fisheries Service. Contact them directly.
(D)	*Delisted*	Delisted. Status to be monitored for 5 years.
(CA)	*State-Listed*	Listed as threatened or endangered by the State of California.
(*)	*Extirpated*	Possibly extirpated from this quad.
(**)	*Extinct*	Possibly extinct.
	Critical Habitat	Area essential to the conservation of a species.

Enclosure B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) and (c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a) Consultation/Conference

Requires: (1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species; (2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and (3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) Biological Assessment-Major Construction Activity[1]

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action[2] on listed and proposed species. The process begins with a Federal agency requesting from FWS a list of proposed and listed threatened and endangered species. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the list, the accuracy of the species list should be informally verified with our Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

We recommend the following for inclusion in the BA: an on-site inspection of the area affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat is present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirement; interviews with experts, including those within FWS, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of indirect effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, and problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

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[1]A construction project (or other undertaking having similar physical impacts) which is a major federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332(2)C).

[2]"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

Enclosure C

GUIDELINES FOR CONDUCTING AND REPORTING BOTANICAL INVENTORIES FOR FEDERALLY LISTED, PROPOSED AND CANDIDATE PLANTS

(September 23, 1996)

These guidelines describe protocols for conducting botanical inventories for federally listed, proposed and candidate plants, and describe minimum standards for reporting results. The Service will use, in part, the information outlined below in determining whether the project under consideration may affect any listed, proposed or candidate plants, and in determining the direct, indirect, and cumulative effects.

Field inventories should be conducted in a manner that will locate listed, proposed, or candidate species (target species) that may be present. The entire project area requires a botanical inventory, except developed agricultural lands. The field investigator(s) should:

1. Conduct inventories at the appropriate times of year when target species are present and identifiable. Inventories will include all potential habitats. Multiple site visits during a field season may be necessary to make observations during the appropriate phenological stage of all target species.

2. If available, use a regional or local reference population to obtain a visual image of the target species and associated habitat(s). If access to reference populations(s) is not available, investigators should study specimens from local herbaria.

3. List every species observed and compile a comprehensive list of vascular plants for the entire project site. Vascular plants need to be identified to a taxonomic level which allows rarity to be determined.

4. Report results of botanical field inventories that include:

    a. a description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species.

    b. a map of project location showing scale, orientation, project boundaries, parcel size, and map quadrangle name

    c. survey dates and survey methodology(ies).

    d. if a reference population is available, provide a written narrative describing the target species reference population(s) used, and date(s) when observations were made.

    e. a comprehensive list of all vascular plants occurring on the project site for each habitat type.

    f. current and historic land uses of the habitat(s) and degree of site alteration.

g. presence of target species off-site on adjacent parcels, if known.

h. an assessment of the biological significance or ecological quality of the project site in a local and regional context.

5. If target species is(are) found, report results that additionally include:

a. a map showing federally listed, proposed and candidate species distribution as they relate to the proposed project.

b. if target species is (are) associated with wetlands, a description of the direction and integrity of flow of surface hydrology. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.

c. the target species phenology and microhabitat, an estimate of the number of individuals of each target species per unit area; identify areas of high, medium and low density of target species over the project site, and provide acres of occupied habitat of target species. Investigators could provide color slides, photos or color copies of photos of target species or representative habitats to support information or descriptions contained in reports.

d. the degree of impact(s), if any, of the proposed project as it relates to the potential unoccupied habitat of target habitat.

6. Document findings of target species by completing California Native Species Field Survey Form(s) and submit form(s) to the Natural Diversity Data Base. Documentation of determinations and/or voucher specimens may be useful in cases of taxonomic ambiguities, habitat or range extensions.

7. Report as an addendum to the original survey, any change in abundance and distribution of target plants in subsequent years. Project sites with inventories older than 3 years from the current date of project proposal submission will likely need additional survey. Investigators need to assess whether an additional survey(s) is (are) needed.

8. Adverse conditions may prevent investigator(s) from determining presence or identifying some target species in potential habitat(s) of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. An additional botanical inventory(ies) in a subsequent year(s) may be required if adverse conditions occur in a potential habitat(s). Investigator(s) may need to discuss such conditions.

9. Guidance from California Department of Fish and Game (CDFG) regarding plant and plant community surveys can be found in Guidelines for Assessing the Effects of Proposed Developments on Rare and Endangered Plants and Plant Communities, 1984. Please contact the CDFG Regional Office for questions regarding the CDFG guidelines and for assistance in determining any applicable State regulatory requirements.

Appendix E

Estimated Air Emissions by Option

TABLE 1

ESTIMATED CONSTRUCTION EQUIPMENT HOURS

Salinity Reduction Option 1A: Napa River & Napa Slough Discharge

	BASE STRUCTURE				FISH SCREENS	KNIFE VALVES		Shallow Draft Tug	Runabout (Small Boat)	Truck	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
Location	Structure Type	Structure length, ft	Number of units	Diameter of units, inches	Number of units	Size and number of valves	TOTAL HOURS FOR ITEM	120 hp	50 hp	100 hp	130 hp	120 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Initial Levee Repair	Ponds 1, 1A, 7, 7A, 8	-	18080	NA	NA	NA	2603.52	579	0	0	723	723	0	0	0	0	579	0
Monitoring- all	Includes replacement of monitoring equipment, as needed	-	50	NA	NA	NA	54750	0	36,500	18,250	0	0	0	0	0	0	0	0
POND 3																		
Napa River to Pond 3	Intake with fish screens	600	9	54	9	9 @ 54"	1782	329.4	0	0	419.4	14.4	405	180	180	0	253.8	0
Dutchman Slough to Pond 3	Intake with fish screens	300	3	48	3	3 @ 48"	351	50.4	0	0	89.4	3	61.2	24	24	0	99	0
Pond 3 to Napa River	Outfall with diffuser	1,100	4	52	NA	4 @ 52"	1052	198	0	0	196	0	214	128	128	0	188	0
PONDS 4/5/6/6A																		
Napa Slough to Pond 6A	Intake with fish screens	250	5	52	5	5 @ 52"	405	70	0	0	124	4.2	85	33.3	33.3	0	55	0
Pond 6A to Pond 6	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 6 to Pond 5	Siphon	250	1	52	NA	1 @ 52"	127	22	0	0	46	0	30	0	16	0	13	0
Napa Slough to Pond 5	Intake with fish screens	500	7	54	7	7 @ 54"	1155	214	0	0	271.8	9.3	262.5	116.7	116.7	0	164.5	0
Pond 5 to Pond 4	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 4 to Napa River	Outfall with diffuser	1,100	2	48	NA	2 @ 48"	526	99	0	0	98	0	107	64	64	0	94	0
PONDS 7/7A/8																		
Napa Slough to Pond 7A	Channel & Intake with fish screens	500	3	52	3	3 @ 52"	495	91.5	0	0	116.5	4	112.5	50	50	0	70.5	0
Pond 8 to Pond 8 Canal	Outlet	200	1	42	NA	1 @ 42"	640	8	0	53	144	0	213	0	107	107	8	0
Pond 8 Canal to Mixing Chamber	Siphon	350	1	42	NA	NA	127	22	0	0	46	0	30	0	16	0	13	0
Mixing Chamber with Inlets and Outlets	Mixing Chamber	NA	NA	NA	NA	1 @ 16", 4 @ 48"	410	0	0	80	226	0	80	0	24	0	0	0
Mix Chamber Outlet Canal to Napa Slough	Outfall with diffuser	300	1	42	NA	1 @ 42"	181.5	21	0	0	84	0	52.5	12	12	0	0	0
Valve Replacement	Replace all Pond 7/7A/8 Valves Once						80	0	0	40	0	0	20	0	20	0	0	0
TOTAL HOURS								18423	2585	758	1801	608	791	107	1537	0	0	0

TABLE 2

ESTIMATED CONSTRUCTION EQUIPMENT HOURS

Salinity Reduction Option 1B: Napa River Discharge with Controlled Levee Breaches

	BASE STRUCTURE				FISH SCREENS	KNIFE VALVES		Shallow Draft Tug	Runabout (Small Boat)	Truck	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
Location	Structure Type	Structure length, ft	Number of units	Diameter of units, inches	Number of units	Size and number of valves	TOTAL HOURS FOR ITEM	120 hp	50 hp	100 hp	130 hp	120 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Initial Levee Repair	Ponds 1, 1A, 7, 7A, 8	-	18080	NA	NA	NA	2603.52	579	0	0	723	723	0	0	0	0	579	0
Monitoring- all	Includes replacement of monitoring equipment, as needed	-	50	NA	NA	NA	54750	0	36,500	18,250	0	0	0	0	0	0	0	0
POND 3																		
Pond 3 to Napa River	External Levee Breach	100	1	NA	NA	NA	48	32	0	0	0	0	16	0	0	0	0	0
PONDS 4/5/6/6A																		
Napa Slough to Pond 6A	Intake with fish screen	250	5	52	5	5 @ 52"	405	70	0	0	124	4.2	85	33.3	33.3	0	55	0
Pond 6A to Pond 6	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 6 to Pond 5	Siphon	250	1	52	NA	1 @ 52"	127	22	0	0	46	0	30	0	16	0	13	0
Napa Slough to Pond 5	Intake with fish screen	500	7	54	7	7 @ 54"	1155	214	0	0	271.8	9.3	262.5	116.7	116.7	0	164.5	0
Pond 5 to Pond 4	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 4 to Napa River	Outfall with diffuser	1,100	2	48	NA	2 @ 48"	526	99	0	0	98	0	107	64	64	0	94	0
PONDS 7/7A/8																		
Napa Slough to Pond 7A	Channel & Intake with fish screen	500	3	52	3	3 @ 52"	486	84	0	0	149	5	102	40	40	0	66	0
Pond 8 to Pond 8 Canal	Outlet	200	1	42	NA	1 @ 42"	640	8	0	53	144	0	213	0	107	107	8	0
Pond 8 Canal to Mixing Chamber	Siphon	350	1	42	NA	NA	127	22	0	0	46	0	30	0	16	0	13	0
Mixing Chamber with Inlets and Outlets	Mixing Chamber	NA	NA	NA	NA	1 @ 16", 4 @ 48"	410	0	0	80	226	0	80	0	24	0	0	0
Mix Chamber Outlet Canal to Napa Slough	Outfall with diffuser	300	1	42	NA	1 @ 42"	181.5	21	0	0	84	0	52.5	12	12	0	0	0
Valve Replacement	Replace all Pond 7/7A/8 Valves Once						80	0	0	40	0	0	20	0	20	0	0	0
TOTAL HOURS								1406	36500	18423	1912	742	1126	266	449	107	992	0

TABLE 3

ESTIMATED CONSTRUCTION EQUIPMENT HOURS

Salinity Reduction Option 1C: Napa River Discharge with Controlled Pond Levee Breaches

	BASE STRUCTURE				FISH SCREENS	KNIFE VALVES		Shallow Draft Tug	Runabout (Small Boat)	Truck	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
Location	Structure Type	Structure length, ft	Number of units	Diameter of units, inches	Number of units	Size and number of valves	TOTAL HOURS FOR ITEM	120 hp	50 hp	100 hp	130 hp	120 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Initial Levee Repair	Ponds 1, 1A, 7, 7A, 8	-	18080	NA	NA	NA	2603.52	579	0	0	723	723	0	0	0	0	579	0
Monitoring- all	Includes replacement of monitoring equipment, as needed	-	50	NA	NA	NA	54750	0	36,500	18,250	0	0	0	0	0	0	0	0
POND 3								0	0	0	0	0	0	0	0	0	0	0
Pond 3 to Napa River	External Levee Breach	100	1	NA	NA	NA	48	32	0	0	0	0	16	0	0	0	0	0
PONDS 4/5/6/6A																		
Napa Slough to Pond 6A	Intake with fish screens	250	5	52	5	5 @ 52"	405	70	0	0	124	4.2	85	33.3	33.3	0	55	0
Pond 6A to Pond 6	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 6 to Pond 5	Siphon	250	1	52	NA	1 @ 52"	127	22	0	0	46	0	30	0	16	0	13	0
Pond 5 to Pond 4	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 4 to Napa River	Levee Breach	1,100	2	48	NA	2 @ 48"	48	32	0	0	0	0	16	0	0	0	0	0
PONDS 7/7A/8																		
Napa Slough to Pond 7A	Channel & Intake with fish screens	500	3	52	3	3 @ 52"	486	84	0	0	149	5	102	40	40	0	66	0
Pond 8 to Pond 8 Canal	Outlet	200	1	42	NA	1 @ 42"	640	8	0	53	144	0	213	0	107	107	8	0
Pond 8 Canal to Mixing Chamber	Siphon	350	1	42	NA	NA	127	22	0	0	46	0	30	0	16	0	13	0
Mixing Chamber with Inlets and Outlets	Mixing Chamber	NA	NA	NA	NA	1 @ 16", 4 @ 48"	410	0	0	80	226	0	80	0	24	0	0	0
Mix Chamber Outlet Canal to Napa Slough	Outfall with diffuser	300	1	42	NA	1 @ 42"	181.5	21	0	0	84	0	52.5	12	12	0	0	0
Valve Replacement	Replace all Pond 7/7A/8 Valves Once						80	0	0	40	0	0	20	0	20	0	0	0
TOTAL HOURS								1126	36500	18423	1542	732	773	85	268	107	734	0

TABLE 4
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
Salinity Reduction Option 2: San Pablo Bay Discharge

	BASE STRUCTURE				FISH SCREENS	KNIFE VALVES		Shallow Draft Tug	Runabout (Small Boat)	Truck	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
Location	Structure Type	Structure length, ft	Number of units	Diameter of units, inches	Number of units	Size and number of valves	TOTAL HOURS FOR ITEM	120 hp	50 hp	100 hp	130 hp	120 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Initial Levee Repair	Ponds 1, 1A, 7, 7A, 8	-	18080	NA	NA	NA	2603.52	579	0	0	723	723	0	0	0	0	579	0
Monitoring- all	Includes replacement of monitoring equipment, as needed	-	50	NA	NA	NA	54750	0	36,500	18,250	0	0	0	0	0	0	0	0
PONDS 3/4/5																		
Napa Slough to Pond 5	Intake with fish screens	500	11	54	11	11 @ 54"	1815	335.5	0	0	427.2	14.7	412.5	183.3	183.3	0	258.5	0
Pond 5 to Pond 4	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 3 to Pond 4	Siphon	350	1	48	NA	1 @ 48"	127	22	0	0	46	0	30	0	16	0	13	0
Napa River to Pond 3	Intake with fish screens	600	9	54	9	9 @ 54"	1782	329.4	0	0	419.4	14.4	405	180	180	0	253.8	0
Dutchman Slough to Pond 3	Intake with fish screens	300	3	48	3	3 @ 48"	291.6	50.4	0	0	89.4	3	61.2	24	24	0	39.6	0
Pond 3 to Napa River	Outfall with diffuser	1,100	2	52	NA	2 @ 52"	526	99	0	0	98	0	107	64	64	0	94	0
PONDS 7/7A/8																		
Napa Slough to Pond 7A	Channel & Intake with fish screens	500	7	54	7	7 @ 54"	1155	213.5	0	0	271.8	9.3	262.5	116.7	116.7	0	164.5	0
Pond 8 to Pond 8 Canal	Outlet	200	1	42	NA	1 @ 42"	640	8	0	53	144	0	213	0	107	107	8	0
Pond 8 Canal to Mixing Chamber	Siphon	350	1	42	NA	NA	127	22	0	0	46	0	30	0	16	0	13	0
Mixing Chamber with Inlets and Outlets	Mixing Chamber	NA	NA	NA	NA	1 @ 32", 4 @ 48"	410	0	0	80	226	0	80	0	24	0	0	0
Mixing Chamber Outlet Canal to Pond 6A	Siphon	350	1	52	NA	1 @ 52"	127	22	0	0	46	0	30	0	16	0	13	0
Valve Replacement	Replace all Pond 7/7A/8 Valves Once						80	0	0	40	0	0	20	0	20	0	0	0
PONDS 1/2/6/6A																		
Pond 6A to Pond 6	Internal Levee Breach	100	4	NA	NA	NA	192	128	0	0	0	0	64	0	0	0	0	0
Pond 6 to Pond 2	Siphon	300	2	54	NA	2 @ 54"	254	44	0	0	92	0	60	0	32	0	26	0
Pond 2 to Pond 1	Siphon	300	2	54	NA	2 @ 54"	254	44	0	0	92	0	60	0	32	0	26	0
Pond 1 to San Pablo Bay	Inlet/Outlet	200	1	72	NA	2 @ 72"	640	8	0	53	144	0	213	0	107	107	8	0
TOTAL HOURS								2032	36500	18476	2865	765	2112	568	938	214	1496	0

TABLE 5
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
Habitat Restoration Option 1

	ESTIMATE BASIS					EQUIPMENT TYPE													
						Shallow Draft Tug	Runabout (Small Boat)	Truck	Truck	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Horizontal Drill Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
COST ITEM	UNITS	UNIT COST (Note 1)	QUANTITY	Construction or Operation?	TOTAL HOURS	120 hp	50 hp	100 hp	300 hp	130 hp	120 hp	115 hp	100 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Initial Levee Repair for 2, 6, & 6A	lineal feet	$19	28,380	C	3860	908	0	0	0	1,135	1,135	0	0	0	0	0	0	681	0
Levee Breaching for Habitat Restoration	no. of breaches	$25,500	23	C	2737	1,357	161	161	0	0	0	0	0	552	0	0	0	506	0
Ditch Blocks with Levee Lowering	no. of blocks	$85,100	22	C	4,620	880	110	110	0	1,760	1,760	0	0	0	0	0	0	0	0
Supplemental Levee Lowering	lineal feet	$51	10,900	C	1,973	610	76	76	0	1,210	0	0	0	0	0	0	0	0	0
Starter Channels with Berms	lineal feet	$336	27,500	C	880	275	41	41	0	0	0	0	0	0	0	0	0	0	523
Fill Area for Interim Mid-Marsh Replacement	per acre	$49,300	-	C	0														
Recreational Features	LS	$2,000,000	1 (Note 7)	C/O	2,178	0	0	0	1,742	0	0	392	44	0	0	0	0	0	0
Recycled Water Pipeline Installation (includes PED, RE, S&A, and permitting)	LS	$14,250,000	1	C	0														
Real Estate (incl. Administrative Costs)	LS	$9,000,000	1	C	0														
Monitoring, all (includes replacement of monitoring equipment, as needed)	years	$12,200,000	50	O	54,750	0	36,500	18,250	0	0	0	0	0	0	0	0	0	0	0
Repair/Replacement of Water Control Structures (Knife Valves) (Note 5)	LS	$2,447,855	12	O	96	48	0	0	0	0	0	0	0	24	0	24	0	0	0
On-Going Levee Maintenance	lineal feet	$19	357,700	O	26,828	8,943	0	0	0	17,885	0	0	0	0	0	0	0	0	0
Other O&M (Note 6)	annual cost	$75,000	50	O	73,000	0	36,500	36,500	0	0	0	0	0	0	0	0	0	0	0
TOTAL HOURS BY EQUIPMENT					341,842	**13,021**	**73,389**	**55,139**	**1,742**	**21,990**	**2,895**	**392**	**44**	**576**	**0**	**24**	**0**	**1,187**	**523**

NOTES:
Decommissioning of some intakes and outfalls is required after desalination. It is assumed that the salvage value of the facilities will be equal to the cost of decommissioning; no added funds are included for decommissioning.
1. All unit costs include indirect costs at 15%, mobilization at 11%, and contractor's overhead and profit at 17% -- a total : 1
2. Initial Levee Maintenance is require for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
3. Assumes 2 42-inch diameter outlets iwht knife valves (one functions a combined intake and outfall)
4. Assumes 50% of the cost of the Pond 4 outfall that serves the combined Pond 4/5
5. Repair/replacement of water control structures and on-going levee maintenance is required for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
6. Other O&M includes operating managed ponds, repair and maintenance of recreational facilities, etc.
7. Based on an assumed paved area of 5 acres, plus incidental structures

TABLE 6
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
Habitat Restoration Option 2

	ESTIMATE BASIS					EQUIPMENT TYPE														
						Shallow Draft Tug	Runabout (Small Boat)	Truck	Truck	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Horizontal Drill Auger	Clamshell Dredge on Barge	Hydraulic Dredge on Barge
COST ITEM	UNITS	UNIT COST (Note 1)	QUANTITY	Construction or Operation?	**TOTAL HOURS**	120 hp	50 hp	100 hp	300 hp	130 hp	120 hp	115 hp	100 hp	100 hp	50 hp	200 hp	300 hp	150 hp	300 hp
Levee Breaching for Habitat Restoration	no. of breaches	$25,500	26	C	3094	1,534	182	182	0	0	0	0	0	624	0	0	0	572	0
Ditch Blocks with Levee Lowering	no. of blocks	$85,100	23	C	4,830	920	115	115	0	1,840	1,840	0	0	0	0	0	0	0	0
Supplemental Levee Lowering	lineal feet	$51	14,900	C	2,697	834	104	104	0	1,654	0	0	0	0	0	0	0	0	0
Starter Channels with Berms	lineal feet	$336	40,600	C	1,299	406	61	61	0	0	0	0	0	0	0	0	0	0	771
Fill Area for Interim Mid-Marsh Replacement	per acre	$49,300	-	C	0														
Recreational Features	LS	$2,000,000	1	C	2,178	0	0	0	1,742	0	0	392	44	0	0	0	0	0	0
Recycled Water Pipeline Installation (includes PED, RE, S&A, and permitting	LS	$14,250,000	1	C	0														
Real Estate (incl. Administrative Costs)	LS	$9,000,000	1	C	0														
Monitoring, all (includes replacement of monitoring equipment, as needed	years	$12,200,000	50	O	54,750	0	36,500	18,250	0	0	0	0	0	0	0	0	0	0	0
Repair/Replacement of Water Control Structures (Knife Valves) (Note 5)	per valve	$0	6	O	48	24	0	0	0	0	0	0	0	12	0	12	0	0	0
On-Going Levee Maintenance	lineal feet	$19	245,796	O	18,435	6,145	0	0	0	12,290	0	0	0	0	0	0	0	0	0
Other O&M (Note 6)	years	$75,000	50	O	73,000	0	36,500	36,500	0	0	0	0	0	0	0	0	0	0	0
TOTAL HOURS BY EQUIPMENT					320,662	**9,863**	**73,462**	**55,212**	**1,742**	**15,784**	**1,840**	**392**	**44**	**636**	**0**	**12**	**0**	**572**	**771**

NOTES:

Decommissioning of some intakes and outfalls is required after desalination. It is assumed that the salvage value of the facilities will be equal to the cost of decommissioning; no added funds are included for decommissioning.

1. All unit costs include indirect costs at 15%, mobilization at 11%, and contractor's overhead and profit at 17% -- a total π 1
2. Initial Levee Maintenance is require for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
3. Assumes 2 42-inch diameter outlets iwht knife valves (one functions a combined intake and outfall)
4. Assumes 50% of the cost of the Pond 4 outfall that serves the combined Pond 4/5
5. Repair/replacement of water control structures and on-going levee maintenance is required for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
6. Other O&M includes labor associated with operating managed ponds, repair and maintenance of recreational facilities, etc.

TABLE 7
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
Habitat Restoration Option 3

COST ITEM	ESTIMATE BASIS: UNITS	ESTIMATE BASIS: UNIT COST (Note 1)	ESTIMATE BASIS: QUANTITY	Construction or Operation?	TOTAL HOURS	Shallow Draft Tug 120 hp	Runabout (Small Boat) 50 hp	Truck 100 hp	Truck 300 hp	Hydraulic Excavator 130 hp	Front End Loader 120 hp	Scraper/ Dozer 115 hp	Vibratory Roller 100 hp	Generator 100 hp	Pile Driver 50 hp	Crane 200 hp	Horizontal Drill Auger 300 hp	Clamshell Dredge on Barge 150 hp	Hydraulic Dredge on Barge 300 hp
Initial Levee Repair for 2, 5, 6, & 6A	lineal feet	$19	29,590	C	4,024	947	0	0	0	1,184	1,184	0	0	0	0	0	0	710	0
Second Pipeline Under Highway 37	LS	$0	-	C															
Replace Pond 1 Pump Station and Pond 1 to 2 Siphon	LS	$0	1	C															
Replace Pond 2 Water Control Structures (Note 3)	LS	$0	1	C															
Pond 2 Internal Levee	LS	$4,606,000	-	C															
Breach Pond 3	LS	$0	1	C															
Pond 4/5 Water Control Structures and Internal Levee Breaches	LS	$0	1	C															
Pond 5 Outfall (Note 4)	number of intakes	$0	2	C	390	67	0	0	0	93	3	0	0	90	40	40	0	56	0
Pond 6 Water Control Structures and Internal Levee Breaches (incl. Pond 5 to 6 Siphon)	LS	$0	1	C	0														
Napa Slough Siphon	LS	$0	-	C	0														
Pond 6 to Pond 2 Siphon	LS	$0	1	C	0														
Ponds 7, 7A, and 8 Water Control Structures and Mixing Chamber	LS	$0	1	C	0														
Discharge from Mixing Chamber to Napa Slough	LS	$0	1	C	0														
Repair Pond 4/5 Levee	lineal feet		400	C	54	13	0	0	0	16	16	0	0	0	0	0	0	10	0
Levee Breaching for Habitat Restoration	no. of breaches	$25,500	16	C	1,904	944	112	112	0	0	0	0	0	384	0	0	0	352	0
Ditch Blocks with Levee Lowering	no. of blocks	$85,100	16	C	3,360	640	80	80	0	1,280	1,280	0	0	0	0	0	0	0	0
Supplemental Levee Lowering	lineal feet	$51	7,700	C	1,394	431	54	54	0	855	0	0	0	0	0	0	0	0	0
Starter Channels with Berms	lineal feet	$336	19,600	C	627	196	29	29	0	0	0	0	0	0	0	0	0	0	372
Fill Area for Interim Mid-Marsh Replacement	per acre	$49,300	-	C	0														
Recreational Features	LS	$2,000,000	1	C	2,178	0	0	0	1,742	0	0	392	44	0	0	0	0	0	0
Recycled Water Pipeline Installation (includes PED, RE, S&A, and permitting)	LS	$14,250,000	1	C	0														
Real Estate (incl. Administrative Costs)	LS	$9,000,000	1	C	0														
Monitoring, all (includes replacement of monitoring equipment, as needed)	years	$12,200,000	50	O	54,750	0	36,500	18,250	0	0	0	0	0	0	0	0	0	0	0
Repair/Replacement of Water Control Structures (Knife Valves) (Note 5)	per valve	$0	21	O	168	84	0	0	0	0	0	0	0	42	0	42	0	0	0
On-Going Levee Maintenance	lineal feet	$19	417,113	O	31,283	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	0
Other O&M (Note 6)	years	$75,000	50	O	73,000	0	36,500	36,500	0	0	0	0	0	0	0	0	0	0	0
TOTAL					173,133	13,750	73,275	55,025	1,742	24,283	2,483	392	44	516	40	82	0	1,128	372

NOTES:
Decommissioning of some intakes and outfalls is required after desalination. It is assumed that the salvage value of the facilities will be equal to the cost of decommissioning; no added funds are included for decommissioni
1. All unit costs include indirect costs at 15%, mobilization at 11%, and contractor's overhead and profit at 17% -- a total 1
2. Initial Levee Maintenance is require for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
3. Assumes 2 42-inch diameter outlets iwht knife valves (one functions a combined intake and outfall)
4. Assumes 50% of the cost of the Pond 4 outfall that serves the combined Pond 4/5
5. Repair/replacement of water control structures and on-going levee maintenance is required for Ponds 1, 1A, 2, 5, 6, 6A, 7, 7A, and 8
6. Other O&M includes labor associated with operating managed ponds, repair and maintenance of recreational facilities, etc.

TABLE 8
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
Habitat Restoration Option 4

COST ITEM	ESTIMATE BASIS: UNITS	UNIT COST (Note 1)	QUANTITY	Construction or Operation?	TOTAL HOURS	EQUIPMENT TYPE: Shallow Draft Tug 120 hp	Runabout (Small Boat) 50 hp	Truck 100 hp	Truck 300 hp	Hydraulic Excavator 130 hp	Front End Loader 120 hp	Scraper/ Dozer 115 hp	Vibratory Roller 100 hp	Generator 100 hp	Pile Driver 50 hp	Crane 200 hp	Horizontal Drill Auger 300 hp	Clamshell Dredge on Barge 150 hp	Hydraulic Dredge on Barge 300 hp
Initial Levee Repair for 2, 6, & 6A	lineal feet	$19	28,380	C	3860	908	0	0	0	1,135	1,135	0	0	0	0	0	0	681	0
Second Pipeline Under Highway 37	LS	$0	-	C															
Replace Pond 1 Pump Station and Pond 1 to 2 Siphon	LS	$0	1	C															
Replace Pond 2 Water Control Structures (Note 3)	LS	$0	1	C															
Pond 2 Internal Levee	LS	$4,606,000	-	C															
Breach Pond 3	LS	$0	1	C															
Pond 4/5 Water Control Structures and Internal Levee Breaches	LS	$0	1	C															
Pond 5 Outfall (Note 4)	LS	$0	-	C															
Pond 6 Water Control Structures and Internal Levee Breaches (incl. Pond 5 to 6 Siphon)	LS	$0	1	C															
Napa Slough Siphon	LS	$0	-	C															
Pond 6 to Pond 2 Siphon	LS	$0	1	C															
Ponds 7, 7A, and 8 Water Control Structures and Mixing Chamber	LS	$0	1	C															
Discharge from Mixing Chamber to Napa Slough	LS	$0	1	C															
Levee Breaching for Habitat Restoration	no. of breaches	$25,500	22	C	2,618	1,298	154	154	0	0	0	0	0	528	0	0	0	484	0
Ditch Blocks with Levee Lowering	no. of blocks	$85,100	22	C	4,620	880	110	110	0	1,760	1,760	0	0	0	0	0	0	0	0
Supplemental Levee Lowering	lineal feet	$51	10,900	C	1,973	610	76	76	0	1,210	0	0	0	0	0	0	0	0	0
Starter Channels with Berms	lineal feet	$336	55,300	C	1,770	553	83	83	0	0	0	0	0	0	0	0	0	0	1,051
Fill Area for Interim Mid-Marsh Replacement	per acre	$49,300	100	C	4,800	1,600	0	0	0	0	0	0	0	0	0	0	0	0	3,200
Recreational Features	LS	$2,000,000	1	C	2,178	0	0	0	1,742	0	0	392	44	0	0	0	0	0	0
Recycled Water Pipeline Installation (includes PED, RE, S&A, and permitting)	LS	$14,250,000	1	C	0														
Real Estate (incl. Administrative Costs)	LS	$9,000,000	1	C	0														
Monitoring, all (includes replacement of monitoring equipment, as needed	years	$12,200,000	50	O	54,750	0	36,500	18,250	0	0	0	0	0	0	0	0	0	0	0
Repair/Replacement of Water Control Structures (Knife Valves) (Note 5)	per valve	$0	12	O	96	48	0	0	0	0	0	0	0	24	0	24	0	0	0
On-Going Levee Maintenance	lineal feet	$19	357,700	O	26,828	8,943	0	0	0	17,885	0	0	0	0	0	0	0	0	0
Other O&M (Note 6)	years	$75,000	50	O	73,000	0	36,500	36,500	0	0	0	0	0	0	0	0	0	0	0
TOTAL					352,983	14,840	73,423	55,173	1,742	21,990	2,895	392	44	552	0	24	0	1,165	4,251

NOTES:

Decommissioning of some intakes and outfalls is required after desalination. It is assumed that the salvage value of the facilities will be equal to the cost of decommissioning; no added funds are included for decommissioning.

1. All unit costs include indirect costs at 15%, mobilization at 11%, and contractor's overhead and profit at 17% -- a total m· 1
2. Initial Levee Maintenance is require for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
3. Assumes 2 42-inch diameter outlets iwht knife valves (one functions a combined intake and outfall)
4. Assumes 50% of the cost of the Pond 4 outfall that serves the combined Pond 4/5
5. Repair/replacement of water control structures and on-going levee maintenance is required for Ponds 1, 1A, 2, 6, 6A, 7, 7A, and 8
6. Other O&M includes labor associated with operating managed ponds, repair and maintenance of recreational facilities, etc.

TABLE 9

INITIAL LEVEE REPAIR AND MAINTENANCE REQUIREMENTS BY ALTERNATIVE (FT.)

Pond No.	Levee Length (ft)	Initial Repair (lineal ft)	Alt 1		Alt 6		Alt 7		Alt 8		Alt 9		Alt 17	
			Initial	Repair	Initial	Repair	Initial	Repair	Initial	Repair	Initial	Repair	Initial	Repair
1	17,750	10,650	-	-	10,650	17,750	10,650	17,750	10,650	17,750	10,650	17,750	10,650	17,750
1A	25,250	3,790	-	-	3,790	25,250	3,790	25,250	3,790	25,250	3,790	25,250	3,790	25,250
2	30,250	24,200	-	-	24,200	30,250	-	-	24,200	30,250	24,200	30,250	24,200	30,250
2W	19,325	6,050	-	-	-	-	6,050	19,325	-	-	-	-	-	-
3	41,250	12,380	-	-	-	-	-	-	-	-	-	-	-	-
4	33,750	-	-	-	-	-	-	-	-	-	-	-	-	-
5	24,250	1,210	-	-	-	-	-	-	1,210	24,250	-	-	-	-
6	18,500	930	-	-	930	18,500	-	-	930	18,500	930	18,500	930	18,500
6A	16,250	3,250	-	-	3,250	16,250	-	-	3,250	16,250	3,250	16,250	3,250	16,250
7	12,375	1,860	-	-	1,860	12,375	1,860	12,375	1,860	12,375	1,860	12,375	1,860	12,375
7A	15,625	780	-	-	780	15,625	780	15,625	780	15,625	780	15,625	780	15,625
8	10,000	1,000	-	-	1,000	10,000	1,000	10,000	1,000	10,000	1,000	10,000	1,000	10,000
TOTAL INITIAL REPAIRS FOR ALT			-		46,460		24,130		47,670		46,460		46,460	
ANNUAL MAINT. FOR ALT				-		7,300		5,016		8,513		7,300		7,300
TOTAL LEVEE MAINT. FOR ALT				-		357,700		245,796		417,113		357,700		357,700

Note: Given the 50-year project life, all alternatives require 49 years of levee maintenance

AIR APPENDIX TABLE 10
ESTIMATED NOx AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	9.049	8.726	8.936	9.403	9.049	8.714	1.363	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	89	3	61	24	24	0	0	**351**
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	196	0	214	128	128	0	0	**1,052**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5 - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	117	4	113	50	50	0	0	**495**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**36,500**	**2,584**	**758**	**1,801**	**608**	**791**	**107**	**18,423**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	36,500	2,584	758	1,801	608	791	107	18,423	65,070
Total Construction Tons:		*1.56*	*0.81*	*6.38*	*1.34*	*0.50*	*1.09*	*0.13*	*0.57*	*0.19*	*1.71*	*0.00*
TOTAL PROJECT TONS:		*1.56*	*0.8*	*6.4*	*1.3*	*0.5*	*1.1*	*0.1*	*0.6*	*0.2*	*1.7*	*14.3*

AIR APPENDIX TABLE 11
ESTIMATED NOx AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	9.049	8.726	8.936	9.403	9.049	8.714	1.363	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	**59,320**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.66*	*0.22*	*6.38*	*0.62*	*0.01*	*0.68*	*0.06*	*0.32*	*0.19*	*1.71*	*0.00*
TOTAL PROJECT TONS:		***0.66***	***0.2***	***6.4***	***0.6***	***0.0***	***0.7***	***0.1***	***0.3***	***0.2***	***1.7***	***10.8***

AIR APPENDIX TABLE 12
ESTIMATED NOx AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	9.049	8.726	8.936	9.403	9.049	8.714	1.363	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.44*	*0.08*	*6.38*	*0.42*	*0.01*	*0.47*	*0.02*	*0.19*	*0.19*	*1.71*	*0.00*
TOTAL PROJECT TONS:		***0.44***	***0.1***	***6.4***	***0.4***	***0.0***	***0.5***	***0.0***	***0.2***	***0.2***	***1.7***	***9.9***

AIR APPENDIX TABLE 13
ESTIMATED NOx AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	9.049	8.726	8.936	9.403	9.049	8.714	1.363	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A-siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*1.16*	*0.48*	*6.38*	*1.11*	*0.03*	*1.28*	*0.12*	*0.67*	*0.39*	*1.71*	*0.00*
TOTAL PROJECT TONS:		***1.16***	***0.5***	***6.4***	***1.1***	***0.0***	***1.3***	***0.1***	***0.7***	***0.4***	***1.7***	***13.3***

AIR APPENDIX TABLE 14
ESTIMATED NOx AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	NOx Emission Factor (g/hp-hr.)	7.923	7.923	7.923	7.923	9.049	8.726	8.811	8.845	8.936	9.049	1.363	0.591	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	0	**2,737**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	275	0	523	41	0	0	0	0	0	0	41		**880**
Recreational Features	C/O	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**1,742**	**170,920**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	871	155,763
Total Operational Tons:		*7.16*	*0.00*	*0.00*	*12.75*	*9.28*	*0.00*	*0.11*	*0.02*	*0.01*	*0.02*	*5.08*	*0.08*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	871	15,157
Total Construction Tons:		*3.21*	*0.62*	*0.55*	*0.07*	*2.13*	*1.89*	*0.11*	*0.02*	*0.34*	*0.00*	*0.04*	*0.08*	*0.00*
TOTAL PROJECT TONS:		***10.37***	***0.6***	***0.5***	***12.8***	***11.4***	***1.9***	***0.2***	***0.0***	***0.3***	***0.0***	***5.1***	***0.2***	*43.5*

AIR APPENDIX TABLE 15
ESTIMATED NOx AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	7.923	9.049	8.726	8.811	8.845	8.936	9.049	1.363	0.591	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoratioi	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowerin;	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowerin;	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed`	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves`	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenanc	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*4.91*	*0.00*	*0.00*	*12.75*	*6.37*	*0.00*	*0.00*	*0.00*	*0.01*	*0.01*	*5.08*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*2.94*	*0.30*	*0.81*	*0.08*	*1.81*	*1.20*	*0.22*	*0.03*	*0.38*	*0.00*	*0.04*	*0.16*	*0.00*
TOTAL PROJECT TONS:		***7.86***	***0.3***	***0.8***	***12.8***	***8.2***	***1.2***	***0.2***	***0.0***	***0.4***	***0.0***	***5.1***	***0.2***	*37.1*

AIR APPENDIX TABLE 16
ESTIMATED NOx AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE													
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	92	200	130	300	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	7.923	9.049	8.726	8.811	8.845	8.936	9.403	9.049	1.363	0.591	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 5, 6, & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	0	**4,025**
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	40	0	0	**389**
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	0	**55**
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	0	112	0	**1,904**
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	0	80	0	**3,360**
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	0	54	0	**1,394**
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	0	29	0	**626**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	0	42	0	0	**168**
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	**31,284**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**40**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	0	42	54,750	0	159,202
Total Operational Tons:		*8.37*	*0.00*	*0.00*	*12.75*	*10.82*	*0.00*	*0.00*	*0.00*	*0.03*	*0.00*	*0.03*	*5.08*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	40	275	1,742	13,931
Total Construction Tons:		*2.58*	*0.59*	*0.39*	*0.05*	*1.78*	*1.62*	*0.22*	*0.03*	*0.29*	*0.01*	*0.03*	*0.03*	*0.16*	*0.00*
TOTAL PROJECT TONS:		***10.95***	***0.6***	***0.4***	***12.8***	***12.6***	***1.6***	***0.2***	***0.0***	***0.3***	***0.0***	***0.1***	***5.1***	***0.2***	***44.8***

AIR APPENDIX TABLE 17
ESTIMATED NOx AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
NOx Emission Factor (g/hp-hr.)		7.923	7.923	7.923	7.923	9.049	8.726	8.811	8.845	8.936	9.049	1.363	0.591	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*7.16*	*0.00*	*0.00*	*12.75*	*9.28*	*0.00*	*0.00*	*0.00*	*0.01*	*0.02*	*5.08*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*4.66*	*0.61*	*4.46*	*0.07*	*2.13*	*1.89*	*0.22*	*0.03*	*0.32*	*0.00*	*0.04*	*0.16*	*0.00*
TOTAL PROJECT TONS:		***11.82***	***0.6***	***4.5***	***12.8***	***11.4***	***1.9***	***0.2***	***0.0***	***0.3***	***0.0***	***5.1***	***0.2***	***48.9***

AIR APPENDIX TABLE 18
ESTIMATED ROG AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE														
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.75	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	92	200	300	130	300	
	ROG Emission Factor (g/hp-hr.)	0.070	0.070	0.070	0.070	0.826	0.773	0.787	0.792	0.776	1.138	0.826	0.775	0.272	0.118	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	0	723	723	0	0	0	0	0	0	0	0	**2,604**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	0	419	14	0	0	405	180	180	0	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	0	89	3	0	0	61	24	24	0	0	0	**351**
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	0	196	0	0	0	214	128	128	0	0	0	**1,052**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	0	124	4	0	0	85	33	33	0	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	0	0	0	64	0	0	0	0	0	**192**
Pond 6 to Pond 5 - siphon	C	22	13	0	0	46	0	0	0	30	0	16	0	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	0	272	9	0	0	263	117	117	0	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	0	0	0	64	0	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	0	98	0	0	0	107	64	64	0	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	0	117	4	0	0	113	50	50	0	0	0	**495**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	0	144	0	0	0	213	0	107	107	53	0	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	0	46	0	0	0	30	0	16	0	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	0	226	0	0	0	80	0	24	0	80	0	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	0	84	0	0	0	53	12	12	0	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	0	0	0	20	0	20	0	40	0	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	0	36,500	0	0	0	0	0	0	0	0	18,250	0	**54,750**
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**0**	**36,500**	**2,584**	**758**	**0**	**0**	**1,801**	**608**	**791**	**107**	**18,423**	**0**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	0	36,500	2,584	758	0	0	1,801	608	791	107	18,423	0	65,070
Total Construction Tons:		*0.01*	*0.01*	*0.00*	*0.06*	*0.12*	*0.04*	*0.00*	*0.00*	*0.09*	*0.02*	*0.05*	*0.02*	*0.34*	*0.00*	*0.00*
TOTAL PROJECT TONS:		***0.01***	***0.0***	***0.0***	***0.1***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.0***	***0.1***	***0.0***	***0.3***	***0.0***	***0.8***

AIR APPENDIX TABLE 19
ESTIMATED ROG AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	ROG Emission Factor (g/hp-hr.)	0.070	0.070	0.070	0.826	0.773	0.776	1.138	0.826	0.775	0.272	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	**59,320**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.01*	*0.00*	*0.06*	*0.06*	*0.00*	*0.06*	*0.01*	*0.03*	*0.02*	*0.34*	*0.00*
TOTAL PROJECT TONS:		***0.01***	***0.0***	***0.1***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.3***	***0.6***

AIR APPENDIX TABLE 20
ESTIMATED ROG AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	ROG Emission Factor (g/hp-hr.)	0.070	0.070	0.070	0.826	0.773	0.776	1.138	0.826	0.775	0.272	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breac	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.00*	*0.00*	*0.06*	*0.04*	*0.00*	*0.04*	*0.00*	*0.02*	*0.02*	*0.34*	*0.00*
TOTAL PROJECT TONS:		***0.00***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.3***	***0.5***

AIR APPENDIX TABLE 21
ESTIMATED ROG AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	***ROG Emission Factor* (g/hp-hr.)**	0.070	0.070	0.070	0.826	0.773	0.776	1.138	0.826	0.775	0.272	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*0.01*	*0.00*	*0.06*	*0.10*	*0.00*	*0.11*	*0.01*	*0.06*	*0.03*	*0.34*	*0.00*
TOTAL PROJECT TONS:		***0.01***	***0.0***	***0.1***	***0.1***	***0.0***	***0.1***	***0.0***	***0.1***	***0.0***	***0.3***	***0.7***

AIR APPENDIX TABLE 22
ESTIMATED ROG AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
ROG Emission Factor (g/hp-hr.)		0.070	0.070	0.070	0.070	0.826	0.773	0.787	0.792	0.776	0.826	0.272	0.118	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	0	**2,737**
Ditch Blocks with Levee Lowerin|	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowerin|	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	275	0	523	41	0	0	0	0	0	0	41		**880**
Recreational Features	C/O	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**1,742**	170,920
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	871	155,763
Total Operational Tons:		*0.06*	*0.00*	*0.00*	*0.11*	*0.85*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*1.01*	*0.02*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	871	15,157
Total Construction Tons:		*0.03*	*0.01*	*0.00*	*0.00*	*0.19*	*0.17*	*0.01*	*0.00*	*0.03*	*0.00*	*0.01*	*0.02*	*0.00*
TOTAL PROJECT TONS:		***0.09***	***0.01***	***0.00***	***0.11***	***1.04***	***0.17***	***0.02***	***0.00***	***0.03***	***0.00***	***1.02***	***0.03***	*2.5*

AIR APPENDIX TABLE 23
ESTIMATED ROG AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
ROG Emission Factor (g/hp-hr.)		0.070	0.070	0.070	0.070	0.826	0.773	0.787	0.792	0.776	0.826	0.272	0.118	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoration	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowering	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowering	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenance	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*0.04*	*0.00*	*0.00*	*0.11*	*0.58*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.01*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*0.03*	*0.00*	*0.01*	*0.00*	*0.17*	*0.11*	*0.02*	*0.00*	*0.03*	*0.00*	*0.01*	*0.03*	*0.00*
TOTAL PROJECT TONS:		***0.07***	***0.00***	***0.01***	***0.11***	***0.75***	***0.11***	***0.02***	***0.00***	***0.03***	***0.00***	***1.02***	***0.03***	***2.2***

AIR APPENDIX TABLE 24
ESTIMATED ROG AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE													
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	92	200	130	300	
ROG Emission Factor (g/hp-hr.)		0.070	0.070	0.070	0.070	0.826	0.773	0.787	0.792	0.776	1.138	0.826	0.272	0.118	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 5, 6, & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	0	**4,025**
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	40	0	0	**389**
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	0	**55**
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	0	112	0	**1,904**
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	0	80	0	**3,360**
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	0	54	0	**1,394**
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	0	29	0	**626**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	0	42	0	0	**168**
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	**31,284**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**40**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	0	42	54,750	0	159,202
Total Operational Tons:		*0.07*	*0.00*	*0.00*	*0.11*	*0.99*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.01*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	40	275	1,742	13,931
Total Construction Tons:		*0.02*	*0.01*	*0.00*	*0.00*	*0.16*	*0.14*	*0.02*	*0.00*	*0.03*	*0.00*	*0.00*	*0.01*	*0.03*	*0.00*
TOTAL PROJECT TONS:		***0.10***	***0.01***	***0.00***	***0.11***	***1.15***	***0.14***	***0.02***	***0.00***	***0.03***	***0.00***	***0.01***	***1.02***	***0.03***	***2.6***

AIR APPENDIX TABLE 25
ESTIMATED ROG AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	ROG Emission Factor (g/hp-hr.)	0.070	0.070	0.070	0.070	0.826	0.773	0.787	0.792	0.776	0.826	0.272	0.118	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*0.06*	*0.00*	*0.00*	*0.11*	*0.85*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.01*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*0.04*	*0.01*	*0.04*	*0.00*	*0.19*	*0.17*	*0.02*	*0.00*	*0.03*	*0.00*	*0.01*	*0.03*	*0.00*
TOTAL PROJECT TONS:		***0.10***	***0.01***	***0.04***	***0.11***	***1.04***	***0.17***	***0.02***	***0.00***	***0.03***	***0.00***	***1.02***	***0.03***	***2.6***

AIR APPENDIX TABLE 26
ESTIMATED CO AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
CO Emission Factor (g/hp-hr.)		1.562	0.781	0.781	3.032	2.910	2.917	3.788	3.032	2.914	1.944	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	89	3	61	24	24	0	0	**351**
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	196	0	214	128	128	0	0	**1,052**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5 - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	117	4	113	50	50	0	0	**495**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**36,500**	**2,584**	**758**	**1,801**	**608**	**791**	**107**	**18,423**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	36,500	2,584	758	1,801	608	791	107	18,423	65,070
Total Construction Tons:		*0.31*	*0.08*	*0.63*	*0.45*	*0.17*	*0.36*	*0.05*	*0.19*	*0.06*	*2.44*	*0.00*
TOTAL PROJECT TONS:		***0.31***	***0.1***	***0.6***	***0.4***	***0.2***	***0.4***	***0.1***	***0.2***	***0.1***	***2.4***	***4.7***

AIR APPENDIX TABLE 27
ESTIMATED CO AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	CO Emission Factor (g/hp-hr.)	1.562	0.781	0.781	3.032	2.910	2.917	3.788	3.032	2.914	1.944	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
& 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	**59,320**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.13*	*0.02*	*0.63*	*0.21*	*0.00*	*0.22*	*0.02*	*0.11*	*0.06*	*2.44*	*0.00*
TOTAL PROJECT TONS:		***0.13***	***0.0***	***0.6***	***0.2***	***0.0***	***0.2***	***0.0***	***0.1***	***0.1***	***2.4***	***3.8***

AIR APPENDIX TABLE 28
ESTIMATED CO AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
CO Emission Factor (g/hp-hr.)		1.562	0.781	0.781	3.032	2.910	2.917	3.788	3.032	2.914	1.944	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.09*	*0.01*	*0.63*	*0.14*	*0.00*	*0.15*	*0.01*	*0.06*	*0.06*	*2.44*	*0.00*
TOTAL PROJECT TONS:		***0.09***	***0.0***	***0.6***	***0.1***	***0.0***	***0.2***	***0.0***	***0.1***	***0.1***	***2.4***	***3.6***

AIR APPENDIX TABLE 29
ESTIMATED CO AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	CO Emission Factor (g/hp-hr.)	1.562	0.781	0.781	3.032	2.910	2.917	3.788	3.032	2.914	1.944	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A-siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*0.23*	*0.05*	*0.63*	*0.37*	*0.01*	*0.42*	*0.05*	*0.22*	*0.13*	*2.44*	*0.00*
TOTAL PROJECT TONS:		***0.23***	***0.0***	***0.6***	***0.4***	***0.0***	***0.4***	***0.0***	***0.2***	***0.1***	***2.4***	***4.5***

AIR APPENDIX TABLE 30
ESTIMATED CO AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE											
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	
	CO Emission Factor (g/hp-hr.)	1.562	0.781	0.781	0.781	3.032	2.910	2.942	2.955	2.917	3.032	1.944	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	**2,737**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	**1,972**
Starter Channels with Berms	C	275	0	523	41	0	0	0	0	0	0	41	**880**
Recreational Features	C/O	0	0	0	0	0	0	392	44	0	0	0	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**170,920**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	155,763
Total Operational Tons:		*1.41*	*0.00*	*0.00*	*1.26*	*3.11*	*0.00*	*0.04*	*0.01*	*0.00*	*0.01*	*7.24*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	15,157
Total Construction Tons:		*0.63*	*0.06*	*0.05*	*0.01*	*0.71*	*0.63*	*0.04*	*0.01*	*0.11*	*0.00*	*0.05*	*0.00*
TOTAL PROJECT TONS:		***2.04***	***0.1***	***0.1***	***1.3***	***3.8***	***0.6***	***0.1***	***0.0***	***0.1***	***0.0***	***7.3***	***15.6***

AIR APPENDIX TABLE 31
ESTIMATED CO AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	CO Emission Factor (g/hp-hr.)	1.562	0.781	0.781	0.781	3.032	2.910	2.942	2.955	2.917	3.032	1.944	0.843	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoration	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowering	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowering	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenance	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*0.97*	*0.00*	*0.00*	*1.26*	*2.14*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*7.24*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*0.58*	*0.03*	*0.08*	*0.01*	*0.61*	*0.40*	*0.07*	*0.01*	*0.12*	*0.00*	*0.06*	*0.23*	*0.00*
TOTAL PROJECT TONS:		***1.55***	***0.0***	***0.1***	***1.3***	***2.7***	***0.4***	***0.1***	***0.0***	***0.1***	***0.0***	***7.3***	***0.2***	***13.8***

AIR APPENDIX TABLE 32
ESTIMATED CO AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE													
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	92	200	130	300	
	CO Emission Factor (g/hp-hr.)	1.562	0.781	0.781	0.781	3.032	2.910	2.942	2.955	2.917	3.788	3.032	1.944	0.843	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 5, 6, & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	0	**4,025**
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	40	0	0	**389**
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	0	**55**
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	0	112	0	**1,904**
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	0	80	0	**3,360**
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	0	54	0	**1,394**
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	0	29	0	**626**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	0	42	0	0	**168**
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	**31,284**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**40**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	0	42	54,750	0	159,202
Total Operational Tons:		*1.65*	*0.00*	*0.00*	*1.26*	*3.62*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*0.01*	*7.24*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	40	275	1,742	13,931
Total Construction Tons:		*0.51*	*0.06*	*0.04*	*0.00*	*0.60*	*0.54*	*0.07*	*0.01*	*0.09*	*0.00*	*0.01*	*0.04*	*0.23*	*0.00*
TOTAL PROJECT TONS:		***2.16***	***0.1***	***0.0***	***1.3***	***4.2***	***0.5***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***7.3***	***0.2***	***16.0***

AIR APPENDIX TABLE 33
ESTIMATED CO AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
CO Emission Factor (g/hp-hr.)		1.562	0.781	0.781	0.781	3.032	2.910	2.942	2.955	2.917	3.032	1.944	0.843	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*1.41*	*0.00*	*0.00*	*1.26*	*3.11*	*0.00*	*0.00*	*0.00*	*0.00*	*0.01*	*7.24*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*0.92*	*0.06*	*0.44*	*0.01*	*0.71*	*0.63*	*0.07*	*0.01*	*0.10*	*0.00*	*0.06*	*0.23*	*0.00*
TOTAL PROJECT TONS:		***2.33***	***0.06***	***0.44***	***1.26***	***3.82***	***0.63***	***0.07***	***0.01***	***0.11***	***0.01***	***7.30***	***0.23***	***16.3***

AIR APPENDIX TABLE 34
ESTIMATED SOx AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	SOx Emission Factor (g/hp-hr.)	1.305	1.305	1.305	0.930	0.930	0.930	0.930	0.930	0.930	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	2,604
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	1,782
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	89	3	61	24	24	0	0	351
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	196	0	214	128	128	0	0	1,052
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	405
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	192
Pond 6 to Pond 5 - siphon	C	22	13	0	46	0	30	0	16	0	0	127
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	1,156
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	192
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	526
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	117	4	113	50	50	0	0	495
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	640
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	127
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	410
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	182
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	80
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	54,750
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**36,500**	**2,584**	**758**	**1,801**	**608**	**791**	**107**	**18,423**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	36,500	2,584	758	1,801	608	791	107	18,423	65,070
Total Construction Tons:		*0.26*	*0.13*	*1.05*	*0.14*	*0.05*	*0.11*	*0.01*	*0.06*	*0.02*	*1.12*	*0.00*
TOTAL PROJECT TONS:		***0.26***	***0.1***	***1.1***	***0.1***	***0.1***	***0.1***	***0.0***	***0.1***	***0.0***	***1.1***	***3.0***

AIR APPENDIX TABLE 35
ESTIMATED SOx AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	SOx Emission Factor (g/hp-hr.)	1.305	1.305	1.305	0.930	0.930	0.930	0.930	0.930	0.930	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
& 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	**59,320**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.11*	*0.04*	*1.05*	*0.06*	*0.00*	*0.07*	*0.01*	*0.03*	*0.02*	*1.12*	*0.00*
TOTAL PROJECT TONS:		***0.11***	***0.0***	***1.1***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***1.1***	***2.5***

AIR APPENDIX TABLE 36
ESTIMATED SOx AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	SOx Emission Factor (g/hp-hr.)	1.305	1.305	1.305	0.930	0.930	0.930	0.930	0.930	0.930	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.07*	*0.01*	*1.05*	*0.04*	*0.00*	*0.05*	*0.00*	*0.02*	*0.02*	*1.12*	*0.00*
TOTAL PROJECT TONS:		***0.07***	***0.0***	***1.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***1.1***	***2.4***

AIR APPENDIX TABLE 37
ESTIMATED SOx AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
SOx Emission Factor (g/hp-hr.)		1.305	1.305	1.305	0.930	0.930	0.930	0.930	0.930	0.930	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A-siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*0.19*	*0.08*	*1.05*	*0.11*	*0.00*	*0.13*	*0.01*	*0.07*	*0.04*	*1.12*	*0.00*
TOTAL PROJECT TONS:		*0.19*	*0.1*	*1.1*	*0.1*	*0.0*	*0.1*	*0.0*	*0.1*	*0.0*	*1.1*	*2.8*

AIR APPENDIX TABLE 38
ESTIMATED SOx AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
SOx Emission Factor (g/hp-hr.)		1.305	1.305	1.305	1.305	0.930	0.930	8.811	0.930	0.930	0.930	0.890	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	0	**2,737**
Ditch Blocks with Levee Lowerin	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowerin	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berm	C	275	0	523	41	0	0	0	0	0	0	41		**880**
Recreational Feature	C/O	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenanc	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**1,742**	**170,920**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	871	155,763
Total Operational Tons:		*1.18*	*0.00*	*0.00*	*2.10*	*0.95*	*0.00*	*0.11*	*0.00*	*0.00*	*0.00*	*3.32*	*0.12*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	871	15,157
Total Construction Tons:		*0.53*	*0.10*	*0.09*	*0.01*	*0.22*	*0.20*	*0.11*	*0.00*	*0.03*	*0.00*	*0.02*	*0.12*	*0.00*
TOTAL PROJECT TONS:		***1.71***	***0.1***	***0.1***	***2.1***	***1.2***	***0.2***	***0.2***	***0.0***	***0.0***	***0.0***	***3.3***	***0.2***	***9.2***

AIR APPENDIX TABLE 39
ESTIMATED SOx AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	SOx Emission Factor (g/hp-hr.)	1.408	1.305	1.305	1.305	0.930	0.930	8.811	0.930	0.930	0.930	0.890	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoration	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowering	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowering	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenance	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*0.87*	*0.00*	*0.00*	*2.10*	*0.66*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.32*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*0.52*	*0.05*	*0.13*	*0.01*	*0.19*	*0.13*	*0.22*	*0.00*	*0.04*	*0.00*	*0.03*	*0.24*	*0.00*
TOTAL PROJECT TONS:		***1.40***	***0.0***	***0.1***	***2.1***	***0.8***	***0.1***	***0.2***	***0.0***	***0.0***	***0.0***	***3.3***	***0.2***	*8.5*

AIR APPENDIX TABLE 40
ESTIMATED SOx AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE													
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	92	200	130	300	
	SOx Emission Factor (g/hp-hr.)	1.408	1.305	1.305	1.305	0.930	0.930	8.811	0.930	0.930	0.930	0.930	0.890	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 5, 6, & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	0	**4,025**
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	40	0	0	**389**
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	0	**55**
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	0	112	0	**1,904**
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	0	80	0	**3,360**
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	0	54	0	**1,394**
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	0	29	0	**626**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	0	42	0	0	**168**
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	**31,284**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**40**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	0	42	54,750	0	159,202
Total Operational Tons:		*1.49*	*0.00*	*0.00*	*2.10*	*1.11*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.32*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	40	275	1,742	13,931
Total Construction Tons:		*0.46*	*0.10*	*0.06*	*0.01*	*0.18*	*0.17*	*0.22*	*0.00*	*0.03*	*0.00*	*0.00*	*0.02*	*0.24*	*0.00*
TOTAL PROJECT TONS:		***1.95***	***0.1***	***0.1***	***2.1***	***1.3***	***0.2***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***	***3.3***	***0.2***	***9.5***

AIR APPENDIX TABLE 41
ESTIMATED SOx AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
SOx Emission Factor (g/hp-hr.)		1.408	1.305	1.305	1.305	0.930	0.930	8.811	0.930	0.930	0.930	0.890	0.890	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*1.27*	*0.00*	*0.00*	*2.10*	*0.95*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.32*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*0.83*	*0.10*	*0.73*	*0.01*	*0.22*	*0.20*	*0.22*	*0.00*	*0.03*	*0.00*	*0.03*	*0.24*	*0.00*
TOTAL PROJECT TONS:		***2.10***	***0.1***	***0.7***	***2.1***	***1.2***	***0.2***	***0.2***	***0.0***	***0.0***	***0.0***	***3.3***	***0.2***	***10.3***

AIR APPENDIX TABLE 42
ESTIMATED PM AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
PM Emission Factor (g/hp-hr.)		0.196	0.196	0.196	0.508	0.461	0.462	0.852	0.508	0.461	0.078	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	89	3	61	24	24	0	0	**351**
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	196	0	214	128	128	0	0	**1,052**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5 - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	117	4	113	50	50	0	0	**495**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**36,500**	**2,584**	**758**	**1,801**	**608**	**791**	**107**	**18,423**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	36,500	2,584	758	1,801	608	791	107	18,423	65,070
Total Construction Tons:		*0.04*	*0.02*	*0.16*	*0.08*	*0.03*	*0.06*	*0.01*	*0.03*	*0.01*	*0.10*	*0.00*
TOTAL PROJECT TONS:		***0.04***	***0.0***	***0.2***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.53***

AIR APPENDIX TABLE 43
ESTIMATED PM AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	PM Emission Factor (g/hp-hr.)	0.196	0.196	0.196	0.508	0.461	0.462	0.852	0.508	0.461	0.078	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
& 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	59,320
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.02*	*0.01*	*0.16*	*0.03*	*0.00*	*0.04*	*0.00*	*0.02*	*0.01*	*0.10*	*0.00*
TOTAL PROJECT TONS:		***0.02***	***0.0***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.1***	***0.38***

AIR APPENDIX TABLE 44
ESTIMATED PM AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	PM Emission Factor (g/hp-hr.)	0.196	0.196	0.196	0.508	0.461	0.462	0.852	0.508	0.461	0.078	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	**48**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.01*	*0.00*	*0.16*	*0.02*	*0.00*	*0.02*	*0.00*	*0.01*	*0.01*	*0.10*	*0.00*
TOTAL PROJECT TONS:		***0.01***	***0.0***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.1***	***0.34***

AIR APPENDIX TABLE 45
ESTIMATED PM AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
PM Emission Factor (g/hp-hr.)		0.196	0.196	0.196	0.508	0.461	0.462	0.852	0.508	0.461	0.078	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A-siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*0.03*	*0.01*	*0.16*	*0.06*	*0.00*	*0.07*	*0.01*	*0.04*	*0.02*	*0.10*	*0.00*
TOTAL PROJECT TONS:		***0.03***	***0.0***	***0.2***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.50***

AIR APPENDIX TABLE 46
ESTIMATED PM AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
PM Emission Factor (g/hp-hr.)		0.208	0.196	0.196	0.196	0.508	0.461	0.474	0.479	0.462	0.508	0.078	0.034	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	0	**2,737**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	275	0	523	41	0	0	0	0	0	0	41		**880**
Recreational Features	C/O	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**1,742**	**170,920**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	871	155,763
Total Operational Tons:		*0.19*	*0.00*	*0.00*	*0.32*	*0.52*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.29*	*0.00*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	871	15,157
Total Construction Tons:		*0.08*	*0.02*	*0.01*	*0.00*	*0.12*	*0.10*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.00*	*0.00*
TOTAL PROJECT TONS:		***0.27***	***0.02***	***0.01***	***0.32***	***0.64***	***0.10***	***0.01***	***0.00***	***0.02***	***0.00***	***0.29***	***0.01***	*1.7*

AIR APPENDIX TABLE 47
ESTIMATED PM AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	PM Emission Factor (g/hp-hr.)	0.208	0.196	0.196	0.196	0.508	0.461	0.474	0.479	0.462	0.508	0.078	0.034	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoration	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowering	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowering	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenance	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*0.13*	*0.00*	*0.00*	*0.32*	*0.36*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*0.08*	*0.01*	*0.02*	*0.00*	*0.10*	*0.06*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.21***	***0.01***	***0.02***	***0.32***	***0.46***	***0.06***	***0.01***	***0.00***	***0.02***	***0.00***	***0.29***	***0.01***	***1.4***

AIR APPENDIX TABLE 48
ESTIMATED PM AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE													
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Pile Driver	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.62	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	92	200	130	300	
PM Emission Factor (g/hp-hr.)		0.208	0.196	0.196	0.196	0.508	0.461	0.474	0.479	0.462	0.852	0.508	0.078	0.034	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 5, 6, & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	0	**4,025**
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	40	0	0	**389**
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	0	**55**
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	0	112	0	**1,904**
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	0	80	0	**3,360**
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	0	54	0	**1,394**
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	0	29	0	**626**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	0	42	0	0	**168**
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	0	**31,284**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**40**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	0	42	54,750	0	159,202
Total Operational Tons:		*0.22*	*0.00*	*0.00*	*0.32*	*0.61*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	40	275	1,742	13,931
Total Construction Tons:		*0.07*	*0.01*	*0.01*	*0.00*	*0.10*	*0.09*	*0.01*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.29***	***0.01***	***0.01***	***0.32***	***0.71***	***0.09***	***0.01***	***0.00***	***0.02***	***0.00***	***0.00***	***0.29***	***0.01***	***1.8***

AIR APPENDIX TABLE 49
ESTIMATED PM AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	PM Emission Factor (g/hp-hr.)	0.196	0.196	0.196	0.196	0.508	0.461	0.474	0.479	0.462	0.508	0.078	0.034	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*0.18*	*0.00*	*0.00*	*0.32*	*0.52*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*0.12*	*0.02*	*0.11*	*0.00*	*0.12*	*0.10*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.29***	***0.02***	***0.11***	***0.32***	***0.64***	***0.10***	***0.01***	***0.00***	***0.02***	***0.00***	***0.29***	***0.01***	***1.8***

AIR APPENDIX TABLE 50
ESTIMATED PM10 AIR EMISSIONS
Salinity Reduction Option 1A

		EQUIPMENT TYPE										
	Equipment	Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
	Horsepower	120	150	50	130	120	100	92	200	300	130	
	PM10 Emission Factor (g/hp-hr.)	0.189	0.189	0.189	0.490	0.445	0.445	0.821	0.490	0.444	0.075	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	99	0	89	3	61	24	24	0	0	**351**
Pond 3 to Napa River -Outfall with diffuser	C	198	188	0	196	0	214	128	128	0	0	**1,052**
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5 - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa Slough to Pond 5- intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 4 to Napa River- outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	92	71	0	117	4	113	50	50	0	0	**495**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,960**	**1,538**	**36,500**	**2,584**	**758**	**1,801**	**608**	**791**	**107**	**18,423**	**65,070**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,960	1,538	36,500	2,584	758	1,801	608	791	107	18,423	65,070
Total Construction Tons:		*0.04*	*0.02*	*0.15*	*0.07*	*0.03*	*0.05*	*0.01*	*0.03*	*0.01*	*0.09*	*0.00*
TOTAL PROJECT TONS:		***0.04***	***0.0***	***0.2***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.51***

AIR APPENDIX TABLE 51
ESTIMATED PM10 AIR EMISSIONS
Salinity Reduction Option 1B

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.490	0.445	0.445	0.821	0.490	0.444	0.075	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
& 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Breach	C	32	0	0	0	0	16	0	0	0	0	**48**
fish screens	C	70	55	0	124	4	85	33	33	0	0	**405**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
screens	C	214	165	0	272	9	263	117	117	0	0	**1,156**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	**486**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	**182**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**828**	**414**	**36,500**	**1,189**	**19**	**1,126**	**266**	**449**	**107**	**18,423**	**59,320**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		828	414	36,500	1,189	19	1,126	266	449	107	18,423	59,320
Total Construction Tons:		*0.02*	*0.01*	*0.15*	*0.03*	*0.00*	*0.03*	*0.00*	*0.02*	*0.01*	*0.09*	*0.00*
TOTAL PROJECT TONS:		***0.02***	***0.0***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.1***	***0.37***

AIR APPENDIX TABLE 52
ESTIMATED PM10 AIR EMISSIONS
Salinity Reduction Option 1C

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.490	0.445	0.445	0.821	0.490	0.444	0.075	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	2,604
Pond 3 to Napa River -External Levee Breach	C	32	0	0	0	0	16	0	0	0	0	48
Napa Slough to Pond 6A- Intake with fish screens	C	70	55	0	124	4	85	33	33	0	0	405
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	192
Pond 6 to Pond 5- siphon	C	22	13	0	46	0	30	0	16	0	0	127
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	192
Pond 4 to Napa River- levee breach	C	32	0	0	0	0	16	0	0	0	0	48
Napa Slough to Pond 7A -channel & intake with fish screens	C	84	66	0	149	5	102	40	40	0	0	486
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	640
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	127
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	410
Mix Chamber Outlet Canal to Napa Slough- outfall with diffuser	C	21	0	0	84	0	53	12	12	0	0	182
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	80
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	54,750
TOTAL PROJECT HOURS:		**547**	**155**	**36,500**	**819**	**9**	**773**	**85**	**268**	**107**	**18,423**	**57,686**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		547	155	36,500	819	9	773	85	268	107	18,423	57,686
Total Construction Tons:		*0.01*	*0.00*	*0.15*	*0.02*	*0.00*	*0.02*	*0.00*	*0.01*	*0.01*	*0.09*	*0.00*
TOTAL PROJECT TONS:		***0.01***	***0.0***	***0.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.1***	***0.33***

AIR APPENDIX TABLE 53
ESTIMATED PM10 AIR EMISSIONS
Salinity Reduction Option 2

		EQUIPMENT TYPE										
Equipment		Tug Boat	Clamshell Dredge	Runabout	Hydraulic Excavator	Front End Loader	Generator	Pile Driver	Crane	Horizontal Drill Auger	Pickup Truck	
Load Factor		0.80	0.80	0.80	0.80	0.68	0.74	0.62	0.4300	0.75	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.8333	0.8333	0.3500	0.8333	0.8333	0.8333	
Horsepower		120	150	50	130	120	100	92	200	300	130	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.490	0.445	0.445	0.821	0.490	0.444	0.075	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair Ponds 1, 1A, 7, 7A, & 8	C	579	579	0	723	723	0	0	0	0	0	**2,604**
Napa Slough to Pond 5- Intake with fish screens	C	336	259	0	427	15	413	183	183	0	0	**1,815**
Pond 5 to Pond 4- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 3 to Pond 4 -siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Napa River to Pond 3- Intake with fish screens	C	329	254	0	419	14	405	180	180	0	0	**1,782**
Dutchman Slough to Pond 3- Intake with fish screens	C	50	40	0	89	3	61	24	24	0	0	**292**
Pond 3 to Napa River -Outfall with diffuser	C	99	94	0	98	0	107	64	64	0	0	**526**
Napa Slough to Pond 7A -channel & intake with fish screens	C	214	165	0	272	9	263	117	117	0	0	**1,155**
Pond 8 to Pond 8 Canal - outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Pond 8 Canal to Mixing Chamber - siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Mixing Chamber with Inlets and Outlets	C	0	0	0	226	0	80	0	24	0	80	**410**
Mix Chamber Outlet Canal to Pond 6A- siphon	C	22	13	0	46	0	30	0	16	0	0	**127**
Valve Replacement Ponds 7/7A/8	C	0	0	0	0	0	20	0	20	0	40	**80**
Pond 6A to Pond 6- internal levee breach	C	128	0	0	0	0	64	0	0	0	0	**192**
Pond 6 to Pond 2- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 2 to Pond 1- siphon	C	44	26	0	92	0	60	0	32	0	0	**254**
Pond 1 to San Pablo Bay- inlet/outlet	C	8	8	0	144	0	213	0	107	107	53	**640**
Monitoring, all (includes replacement of monitoring equipment, as needed)	C	0	0	36,500	0	0	0	0	0	0	18,250	**54,750**
TOTAL PROJECT HOURS:		**1,454**	**917**	**36,500**	**2,142**	**41**	**2,112**	**568**	**938**	**214**	**18,476**	**63,363**
TOTAL Operational Hours:		0	0	0	0	0	0	0	0	0	0	0
Total Operational Tons:		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Construction Hours:		1,454	917	36,500	2,142	41	2,112	568	938	214	18,476	63,363
Total Construction Tons:		*0.03*	*0.01*	*0.15*	*0.06*	*0.00*	*0.06*	*0.01*	*0.04*	*0.02*	*0.09*	*0.00*
TOTAL PROJECT TONS:		***0.03***	***0.0***	***0.2***	***0.1***	***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.48***

AIR APPENDIX TABLE 54
ESTIMATED PM10 AIR EMISSIONS
Habitat Restoration Option 1

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.189	0.490	0.445	0.457	0.462	0.445	0.490	0.075	0.033	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,357	506	0	161	0	0	0	0	552	0	161	0	**2,737**
Ditch Blocks with Levee Lowerin	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowerin	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	275	0	523	41	0	0	0	0	0	0	41		**880**
Recreational Features	C/O	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**13,021**	**1,187**	**523**	**73,388**	**21,990**	**2,895**	**392**	**44**	**576**	**24**	**55,138**	**1,742**	**170,920**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	196	22	24	24	54,750	871	155,763
Total Operational Tons:		*0.17*	*0.00*	*0.00*	*0.30*	*0.50*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.28*	*0.00*	*0.00*
Total Construction Hours:		4,030	1,187	523	388	4,105	2,895	196	22	552	0	388	871	15,157
Total Construction Tons:		*0.08*	*0.01*	*0.01*	*0.00*	*0.12*	*0.10*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.00*	*0.00*
TOTAL PROJECT TONS:		***0.25***	***0.0***	***0.0***	***0.3***	***0.6***	***0.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.3***	***0.0***	***1.6***

AIR APPENDIX TABLE 55
ESTIMATED PM10 AIR EMISSIONS
Habitat Restoration Option 2

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.189	0.490	0.445	0.457	0.462	0.445	0.490	0.075	0.033	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Levee Breaching for Habitat Restoration	C	1,534	572	0	182	0	0	0	0	624	0	182	0	**3,094**
Ditch Blocks with Levee Lowering	C	920	0	0	115	1,840	1,840	0	0	0	0	115	0	**4,830**
Supplemental Levee Lowering	C	834	0	0	104	1,654	0	0	0	0	0	104	0	**2,696**
Starter Channels with Berms	C	406	0	771	61	0	0	0	0	0	0	61	0	**1,299**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	24	0	0	0	0	0	0	0	12	12	0	0	**48**
On-Going Levee Maintenance	O	6,145	0	0	0	12,290	0	0	0	0	0	0	0	**18,435**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**9,863**	**572**	**771**	**73,462**	**15,784**	**1,840**	**392**	**44**	**636**	**12**	**55,212**	**1,742**	**160,330**
TOTAL Operational Hours:		6,169	0	0	73,000	12,290	0	0	0	12	12	54,750	0	146,233
Total Operational Tons:		*0.12*	*0.00*	*0.00*	*0.30*	*0.35*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.28*	*0.00*	*0.00*
Total Construction Hours:		3,694	572	771	462	3,494	1,840	392	44	624	0	462	1,742	14,097
Total Construction Tons:		*0.07*	*0.01*	*0.02*	*0.00*	*0.10*	*0.06*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.19***	***0.0***	***0.0***	***0.3***	***0.4***	***0.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.3***	***0.0***	***1.3***

AIR APPENDIX TABLE 56
ESTIMATED PM10 AIR EMISSIONS
Habitat Restoration Option 3

		EQUIPMENT TYPE												
Equipment		Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
Load Factor		0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
Operating Factor		0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
Horsepower		120	150	300	50	130	120	115	151	100	200	130	300	
PM10 Emission Factor (g/hp-hr.)		0.189	0.189	0.189	0.189	0.490	0.445	0.457	0.462	0.445	0.490	0.075	0.033	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL HOURS
Initial Levee Repair for Ponds 2, 5, 6 & 6A	C	947	710	0	0	1,184	1,184	0	0	0	0	0	0	4,025
Pond 5 Outfall	C	67	56	0	0	93	3	0	0	90	40	0	0	389
Repair Pond 4/5 Levee	C	13	10	0	0	16	16	0	0	0	0	0	0	55
Levee Breaching for Habitat Restoration	C	944	352	0	112	0	0	0	0	384	0	112	0	1,904
Ditch Blocks with Levee Lowering	C	640	0	0	80	1,280	1,280	0	0	0	0	80	0	3,360
Supplemental Levee Lowering	C	431	0	0	54	855	0	0	0	0	0	54	0	1,394
Starter Channels with Berms	C	196	0	372	29	0	0	0	0	0	0	29	0	626
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	2,178
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	54,750
Repair/Replacement of Water Control Structures (Knife Valves)	O	84	0	0	0	0	0	0	0	42	42	0	0	168
On-Going Levee Maintenance	O	10,428	0	0	0	20,856	0	0	0	0	0	0	0	31,284
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	73,000
TOTAL PROJECT HOURS:		**13,750**	**1,128**	**372**	**73,275**	**24,284**	**2,483**	**392**	**44**	**516**	**82**	**55,025**	**1,742**	**173,133**
TOTAL Operational Hours:		10,512	0	0	73,000	20,856	0	0	0	42	42	54,750	0	159,202
Total Operational Tons:		*0.20*	*0.00*	*0.00*	*0.30*	*0.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.28*	*0.00*	*0.00*
Total Construction Hours:		3,238	1,128	372	275	3,428	2,483	392	44	474	40	275	1,742	13,931
Total Construction Tons:		*0.06*	*0.01*	*0.01*	*0.00*	*0.10*	*0.08*	*0.01*	*0.00*	*0.01*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.26***	***0.0***	***0.0***	***0.3***	***0.7***	***0.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.3***	***0.0***	***1.7***

AIR APPENDIX TABLE 57
ESTIMATED PM10 AIR EMISSIONS
Habitat Restoration Option 4

		EQUIPMENT TYPE												
	Equipment	Tug Boat	Clamshell Dredge	Hydraulic Dredge	Runabout	Hydraulic Excavator	Front End Loader	Scraper/ Dozer	Vibratory Roller	Generator	Crane	Pickup Truck	Dump Truck	
	Load Factor	0.80	0.80	0.80	0.80	0.80	0.68	0.59	0.56	0.74	0.4300	0.57	0.57	
	Operating Factor	0.95	0.50	0.50	0.50	0.50	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	
	Horsepower	120	150	300	50	130	120	115	151	100	200	130	300	
	PM10 Emission Factor (g/hp-hr.)	0.189	0.189	0.189	0.189	0.490	0.445	0.457	0.462	0.445	0.490	0.075	0.033	
TASK	Construction or Operation?	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	**TOTAL HOURS**
Initial Levee Repair for Ponds 2, 6, & 6A	C	908	681	0	0	1,135	1,135	0	0	0	0	0	0	**3,859**
Levee Breaching for Habitat Restoration	C	1,298	484	0	154	0	0	0	0	528	0	154	0	**2,618**
Ditch Blocks with Levee Lowering	C	880	0	0	110	1,760	1,760	0	0	0	0	110	0	**4,620**
Supplemental Levee Lowering	C	610	0	0	76	1,210	0	0	0	0	0	76	0	**1,972**
Starter Channels with Berms	C	553	0	1,051	83	0	0	0	0	0	0	83	0	**1,770**
Fill Area for Interim Mid-Marsh Replacement	C	1,600	0	3,200	0	0	0	0	0	0	0	0	0	**4,800**
Recreational Features	C	0	0	0	0	0	0	392	44	0	0	0	1,742	**2,178**
Monitoring, all (includes replacement of monitoring equipment, as needed)	O	0	0	0	36,500	0	0	0	0	0	0	18,250	0	**54,750**
Repair/Replacement of Water Control Structures (Knife Valves)	O	48	0	0	0	0	0	0	0	24	24	0	0	**96**
On-Going Levee Maintenance	O	8,943	0	0	0	17,885	0	0	0	0	0	0	0	**26,828**
Other O&M	O	0	0	0	36,500	0	0	0	0	0	0	36,500	0	**73,000**
TOTAL PROJECT HOURS:		**14,840**	**1,165**	**4,251**	**73,423**	**21,990**	**2,895**	**392**	**44**	**552**	**24**	**55,173**	**1,742**	**176,491**
TOTAL Operational Hours:		8,991	0	0	73,000	17,885	0	0	0	24	24	54,750	0	154,674
Total Operational Tons:		*0.17*	*0.00*	*0.00*	*0.30*	*0.50*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.28*	*0.00*	*0.00*
Total Construction Hours:		5,849	1,165	4,251	423	4,105	2,895	392	44	528	0	423	1,742	21,817
Total Construction Tons:		*0.11*	*0.01*	*0.11*	*0.00*	*0.12*	*0.10*	*0.01*	*0.00*	*0.02*	*0.00*	*0.00*	*0.01*	*0.00*
TOTAL PROJECT TONS:		***0.28***	***0.0***	***0.1***	***0.3***	***0.6***	***0.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.3***	***0.0***	***1.7***

TABLE 58
ESTIMATED CONSTRUCTION EQUIPMENT HOURS
No Project Alternative Option

COST ITEM	ESTIMATE BASIS			Construction or Operation?	TOTAL HOURS	EQUIPMENT TYPE	
	UNITS	UNIT COST	QUANTITY			Runabout (Small Boat) 50 hp	Truck 100 hp
Monitoring, all (includes replacement of monitoring equipment, as needed)	years	$500,000	10	C	10,950	7,300	3,650
Other O&M	annual cost	$10,000	50	C	73,000	36,500	36,500
TOTAL HOURS BY EQUIPMENT					**83,950**	**43,800**	**40,150**

NOTES:
Other O&M task includes limited levee maintanance and water structure repair.
The amount of monitoring and maintanencae and repair is limited to within the DFG budget.
All unit costs include indirect costs at 15%, mobilization at 11%, and contractor's overhead and profit at 17%

AIR APPENDIX TABLE 59
ESTIMATED NOx AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
Equipment		Runabout	Pickup Truck	
Load Factor		0.80	0.57	
Operating Factor		0.50	0.8333	
Horsepower		50	130	
NOx Emission Factor (g/hp-hr.)		7.923	1.363	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	O	*1.28*	*0.34*	***1.6***
Other O&M		36,500	36,500	
Tons per Task:	O	*6.38*	*3.39*	***9.8***
TOTAL PROJECT HOURS:		**43,803**	**40,151**	**83,953**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*7.65*	*3.72*	***0.00***
TOTAL PROJECT TONS:		*7.7*	***3.7***	***11.4***

Note: The other O& M task includes limited levee maintanance and repair of water control structures.
The amount of work for both tasks is limited to within the DFG budget.

AIR APPENDIX TABLE 60
ESTIMATED ROG AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
Equipment		Runabout	Pickup Truck	
Load Factor		0.80	0.57	
Operating Factor		0.50	0.8333	
Horsepower		50	130	
ROG Emission Factor (g/hp-hr.)		0.070	0.272	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	O	*0.01*	*0.07*	***0.1***
Other O&M		36,500	36,500	
Tons per Task:	O	*0.06*	*0.68*	***0.7***
TOTAL PROJECT HOURS:		**43,800**	**40,150**	**83,950**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*0.07*	*0.74*	***0.00***
TOTAL PROJECT TONS:		***0.1***	***0.7***	***0.8***

Note: The other O& M task includes limited levee maintanance and repair of water control structures. The amount of work for both tasks is limited to within the DFG budget.

AIR APPENDIX TABLE 61
ESTIMATED CO AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
	Equipment	Runabout	Pickup Truck	
	Load Factor	0.80	0.57	
	Operating Factor	0.50	0.8333	
	Horsepower	50	130	
	NOx Emission Factor (g/hp-hr.)	0.781	1.944	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	O	*0.13*	*0.48*	***0.6***
Other O&M		36,500	36,500	
Tons per Task:	O	*0.63*	*4.83*	***5.5***
TOTAL PROJECT HOURS:		**43,800**	**40,151**	**83,951**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*0.75*	*5.31*	***0.00***
TOTAL PROJECT TONS:		***0.8***	***5.3***	***6.1***

Note: The other O& M task includes limited levee maintanance and repair of water control structures. The amount of work for both tasks is limited to within the DFG budget.

AIR APPENDIX TABLE 62
ESTIMATED SOx AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
Equipment		Runabout	Pickup Truck	
Load Factor		0.80	0.57	
Operating Factor		0.50	0.8333	
Horsepower		50	130	
NOx Emission Factor (g/hp-hr.)		1.305	0.890	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	O	*0.21*	*0.22*	***0.4***
Other O&M		36,500	36,500	
Tons per Task:	O	*1.05*	*2.21*	***3.3***
TOTAL PROJECT HOURS:		**43,800**	**40,150**	**83,951**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*1.26*	*2.43*	***0.00***
TOTAL PROJECT TONS:		***1.3***	***2.4***	***3.7***

Note: The other O& M task includes limited levee maintanance and repair of water control structures. The amount of work for both tasks is limited to within the DFG budget.

AIR APPENDIX TABLE 63
ESTIMATED PM AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
Equipment		Runabout	Pickup Truck	
Load Factor		0.80	0.57	
Operating Factor		0.50	0.8333	
Horsepower		50	130	
NOx Emission Factor (g/hp-hr.)		0.196	0.078	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	O	*0.03*	*0.02*	***0.1***
Other O&M		36,500	36,500	
Tons per Task:	O	*0.16*	*0.19*	***0.4***
TOTAL PROJECT HOURS:		**43,800**	**40,150**	**83,950**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*0.19*	*0.21*	***0.00***
TOTAL PROJECT TONS:		*0.2*	*0.2*	***0.40***

Note: The other O& M task includes limited levee maintanance and repair of water control structures. The amount of work for both tasks is limited to within the DFG budget.

AIR APPENDIX TABLE 64
ESTIMATED PM10 AIR EMISSIONS
No Project Alternative Option

		EQUIPMENT TYPE		
	Equipment	Runabout	Pickup Truck	
	Load Factor	0.80	0.57	
	Operating Factor	0.50	0.8333	
	Horsepower	50	130	
	NOx Emission Factor (g/hp-hr.)	0.189	0.075	
TASK	Construction or Operation?	Hours	Hours	**TOTAL TONS**
Monitoring, all (includes replacement of monitoring equipment, as needed)		7,300	3,650	
Tons per Task:	C	*0.03*	*0.02*	***0.05***
Other O&M		36,500	36,500	
Tons per Task:	C	*0.15*	*0.19*	***0.34***
TOTAL PROJECT HOURS:		**43,800**	**40,150**	**83,950**
TOTAL Operational Hours:		0	0	0
Total Operational Tons:		*0.00*	*0.00*	***0.0***
Total Construction Hours:		43,800	40,150	0
Total Construction Tons:		*0.18*	*0.20*	***0.00***
TOTAL PROJECT TONS:		***0.2***	***0.2***	***0.39***

Note: The other O& M task includes limited levee maintanance and repair of water control structures. The amount of work for both tasks is limited to within the DFG budget.